UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278-0012

APR 06 1994

Mr. Al Harring
Installation Restoration Branch
Naval Facilities Engineering Command
Northern Division
10 Industrial Highway
Lester, PA 19113-2090

Re: Naval Weapons Industrial Reserve Plant - Bethpage, NY

Dear Mr. Harring:

This is to inform you that the U.S. Environmental Protection Agency's (EPA) Region II office has reviewed the SI which you submitted for the Naval Weapons Industrial Reserve Plant - Bethpage, NY. Attached is the review dated August 3, 1993 prepared by our contractor Malcolm Pirnie, Inc.

We are retaining this site for further evaluation and potential listing on the National Priorities List (NPL). At this time, further information and sampling is not being requested of you for your facility as the submitted data appears adequate for NPL evaluation of the site. However, should we later find that additional data is needed for NPL evaluation, we will notify you in writing at that time. We will otherwise advise you of any further determination with regard to this site.

If you have any questions, please call Alida Karas or Helen Shannon of my staff at (212) 264-8776 and (212) 264-6664 respectively.

Sincerely yours,

Robert J. Wing

Robert J. Wing, Chief
Federal Facilities Section

Attachment

Report No.: 8003-088
Rev. No.: 0

FINAL DRAFT
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT - BETHPAGE, NY
FEDERAL FACILITY SI REVIEW
DOCUMENTATION PACKAGE
PREPARED UNDER

WORK ASSIGNMENT NO. 019-2JZZ
CONTRACT NO. 68-W9-0051

SEPTEMBER 30,1992
Updated: August 3, 1993

VOLUME 1 OF 5

SUBMITTED BY:

DAVID KAHLENBERG
SITE MANAGER

JOHN D. RIECKHOFF
PROJECT TASK LEADER

DENNIS STAINKEN, Ph.D.
WORK ASSIGNMENT MANAGER

FEDERAL FACILITY SITE SI REVIEW FORM

EPA REGION II

Federal Facility Name: Naval Weapons Industrial Reserve Plant - Bethpage, NY

Aliases: ____________

EPA ID: NY217022162

Address: South Oyster Bay Rd.

City: Bethpage

County: Nassau

State: New York

1. Provide the name of document(s) reviewed and organization responsible for its preparation.

2. HRS Score or Priority given: 71

   Check one __X__ Agree (Go to line 7)

   ______ Disagree (Go to line 3)

   ______ No priority given (Go to line 4)

3. If disagree, why?

4. Is information adequate to provide a recommendation?

   __X__ Yes (Go to line 6) ______ No (Go to line 5)

5. If information is not adequate, check the type of information needed to complete the PA/SI review, then go to line 7.

______	Waste source type(s)	______	Site Slope
______	Containment	______	Topography
______	Physical state of waste	______	Surface water uses
______	Hazardous constituents	______	Location of sensitive environments
______	Aquifer description	______	¼ - mile radius population
______	Site geology	______	½ - mile radius population
______	Groundwater uses	______	1 - mile radius population
______	Groundwater populations	______	2 - mile radius population
______	Water supply well locations	______	3 - mile radius population
______	Surface water intakes	______	4 - mile radius population
______	Private well locations	______	Wellhead protection area
______	Onsite workers	______	Surface water population
______	Site sampling	______	Schools, day care centers

Note that the information aforementioned is, but not limited to, the type of data required to complete an evaluation of the site.

6. Is there sufficient environmental sampling data to support the migration assessment and to evaluate any potential imminent health threats?

_X__ Yes

______ No

7. Recommendation: **Lower Priority for Further Action**

8. Comments (if any): provide the rationale for the recommendation.

- Groundwater samples collected during the remedial investigation indicate the presence of both organic and inorganic constituents.

- Groundwater is extensively utilized as a source for potable water within a four-mile vicinity of the site. However, there have been no Level I or II targets identified.

- Surface water samples collected from the groundwater recharge basins during the remedial investigation indicated levels of both inorganic and organic constituents. However, there is a low potential for off-site contaminant migration due to the presence of a stormwater management system which collects and diverts all runoff to the three groundwater recharge basins present on the site property.

- Contaminants are found in various locations on the site property at levels that are elevated when compared to those found in other areas with less influence by the activities conducted during facility operations. However, access to the property is limited due to the presence of a fence along the site's perimeter.

- There is no analytical documentation indicating a release of contaminants from the site property to the air.

SITE SUMMARY

The Naval Weapons Industrial Reserve Plant (NWIRP) site is situated on 108 acres in Bethpage, Nassau County, New York and is owned by the United States Navy. The NWIRP is located entirely within the Grumman Aerospace Corporation complex and is bordered on the north, west, and south by Grumman Facilities and a residential neighborhood on the east. The NWIRP facility was established in 1933 to conduct research, development, and production of military aircraft. A site location and site map for the NWIRP site can be found in Reference 6, pp. 37-38.

In 1986 a Naval Energy and Environmental Support Activity (NEESA) Initial Assessment Study (IAS) was conducted at the NWIRP site in Bethpage. The IAS identified three areas, which were adjacent to Plant No. 3, a large aircraft component manufacturing building, at the site which may pose a threat to human health or the environment: the former drum-marshaling area (Site No. 1), recharge basins and sludge-drying beds (Site No. 2), and the salvage storage yard (Site No. 3).

The former drum-marshaling area was used from the 1950s until the early 1980s as a storage and assembly area for drummed wastes. The storage area was unlined and uncovered. Hazardous materials that were stored in the area include cadmium-bearing liquids, halogenated and non-halogenated solvents, and cyanide-containing materials. Additionally, the drum-marshaling area was underlain by a septic system leach field that was connected to Plant No. 3. Contaminants may have been inadvertently discharged to the leach field in the past.

Site No. 2, the sludge-drying beds, is adjacent to Site No. 1. Three groundwater recharge basins are present nearby; which are presently used to discharge non-contact cooling water, treated process wastewater, and storm water runoff to these surface water bodies. Before the 1980s, contact cooling water from Plant No. 3 was discharged to the basins. A sludge-drying area for the dewatering of wastewater treatment plant sludges is adjacent to the recharge basins. This area was used for the dewatering by infiltration of sludges from the Plant No. 2 wastewater treatment plant. These sludges may have contained elevated levels of inorganic compounds, including hexavalent chromium.

Site No. 3, the salvage storage yard, is adjacent to Plant No. 3 and the recharge basins. The area has been used since the 1950s for the storage and recycling of fixtures, tools, and metallic wastes. The area has been downsized several times in its history as parking lots have been expanded. Contaminants potentially present include heavy metals, cutting oils, and waste halogenated and non-halogenated solvents.

In 1992 a Remedial Investigation (RI) was conducted at NWIRP under the Comprehensive Long-Term Environmental Action Navy (CLEAN) program to characterize the nature and extent of potential environmental contamination and the associated risks to human health and the environment at NWIRP. During this investigation samples were taken from the site's groundwater, soil, and the recharge basin's surface water and sediments. The residential population in the site's vicinity rely on the groundwater for potable water which is supplied by municipal water companies. There are numerous municipal potable water wells located within four miles of NWIRP with the closest well located approximately 0.75 miles east of the site. The nearest downslope surface water are the three groundwater recharge basins located in Site No. 2 of NWIRP. Each of these basins are approximately 1.35 million ft^3 in size. Stormwater, non-contact cooling water, and treatment production line rinse waters discharge to these groundwater recharge basins. Access to the NWIRP site is limited by both a fence and guards and there are private residences located within two hundred feet of the Site Nos. 1 and 2 within NWIRP.

Based on information contained in the remedial investigation report and the additional information collected both the groundwater, and soil exposure pathways are of primary concern. Groundwater samples collected during the remedial investigation indicate the presence of both organic and inorganic constituents. Groundwater is extensively utilized as a source for potable water with four miles of the site. Surface water samples collected from the groundwater recharge basins during the remedial investigation indicated levels of both inorganic and organic constituents. However, there is a low potential for off-site contaminant migration due to the presence of a stormwater management system which collects and diverts all runoff to the three groundwater recharge basins present on the site property. Contaminants are found in various locations on the site property at levels that are elevated when compared to those found in other areas with less influence by the activities conducted during facility operations. There is no analytical documentation indicating a release of contaminants from the site property to the air.

Report No.: 8003-088
Rev. No.: 0

SITE ASSESSMENT REPORT: SITE INSPECTION

PART I: SITE INFORMATION

1. Site Name/Alias Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage

   Street South Oyster Bay Road

   City Bethpage State NY Zip 11714

2. County Nassau County Code 059 Cong.Dist. ______

3. CERCLIS ID NO. NY217022162

4. Block No. ______ Lot No. ______

5. Latitude 40°45'17"N Longitude 73°29'38"W

   USGS Quad. Huntington/Amityville/Hicksville/Freeport

6. Approximate size of site 108 acres

7. Owner COMNAVAIRSYSCOM Telephone No. ______

   Street Naval Systems Air Command Headquarters, Jefferson Plaza 2, Room 528

   City Washington State DC Zip 20361

8. Operator Grumman Aerospace Corp. Telephone No. ______

   Street Stewart Avenue

   City Bethpage State NY Zip 11714

9. Type of Ownership

   __ Private X Federal __ State

   __ County __ Municipal __ Unknown __ Other ______

10. Owner/Operator Notification on File

    __ RCRA 3001 __ Date ______ __ CERCLA 103c Date ______

    __ None X Unknown

11. Permit Information

Permit	Permit No.	Date Issued	Expiration Date	Comments
SPDES	NY0096792			cooling water discharge

12. Site Status

    X Active __ Inactive __ Unknown

13. Years of Operation 1933 to present

14. Identify the types of waste sources (e.g., landfill, surface impoundment, piles, stained soil, above- or below-ground tanks or containers, land treatment, etc.) on site. Initiate as many waste unit numbers as needed to identify all waste sources on site.

(a) Waste Sources

Waste Unit No.	Waste Source Type	Facility Name for Unit
1	Contaminated Soil	Site 1: Drum-Marshaling Area
2	Contaminated Soil	Site 2: Sludge-Drying Beds
3	Contaminated Soil	Site 3: Salvage Storage Yard

(b) Other Areas of Concern

Identify any miscellaneous spills, dumping, etc. on site; describe the materials and identify their locations on site.

None

15. Information available from

Contact Sandy Foose Agency U.S. EPA Telephone No. (908)906-6802

Preparer David Kahlenberg Agency MALCOLM PIRNIE, INC. Date September 30, 1992

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site No. 1 - Drum-Marshaling Area

Source Type

____	Landfill	X	Contaminated Soil
____	Surface Impoundment	____	Pile
____	Drums	____	Land Treatment
____	Tanks/Containers	____	Other (leaking pipelines)

Description:

The site is an open area that is approximately 400 by 400 feet in size. It was used from the early 1950s until 1978 as an assembly area and for the storage of drums containing liquid cadmium waste, cyanide, and waste halogenated and non-halogenated solvents. The area is unlined and uncovered and up to 300 drums were present at one time. The area was formerly the site of a septic system leach field that served Plant No. 3. The plant has been in operation since approximately 1940 and has been host to a wide variety of metal-finishing operations, including metal cleaning, painting, and electroplating.

Hazardous Waste Quantity

The quantity of waste stored and/or disposed here is not known. The area of the site (400 by 400 feet) is 160,000 ft^2.

Hazardous Substances/Physical State

Any wastes stored/spilled/disposed in this area were probably in a liquid form: either liquids in drums or liquids entering the former septic leach field. Potential contaminants include cadmium, other metals, and halogenated/non-halogenated solvents.

Ref. No. 6, pp. 60-62

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site No. 2 - Sludge-Drying Beds

Source Type

______	Landfill	X	Contaminated Soil
______	Surface Impoundment	______	Pile
______	Drums	______	Land Treatment
______	Tanks/Containers	______	Other (leaking pipelines)

Description:

An approximate 300 by 300 foot area adjacent to the recharge basins was used formerly to dewater process wastewater treatment plant sludges generated from Plant No. 2. Sludges were piled in this area to allow water to infiltrate into the soil prior to disposal.

Hazardous Waste Quantity

The volume of sludges stored in this area is not known. A one time use of the area of the drying beds (300 by 300 feet) equals 90,000 ft^2.

Hazardous Substances/Physical State

Wastes were deposited in this area as wet sludge. Plant No. 2 processes included metal-finishing activities. Wastewaters from the plant were sent to a wastewater treatment plant on site. The sludges dewatered in this area were generated by the treatment plant. Potential contaminants included heavy metals such as hexavalent chromium.

Ref. No. 6, pp. 62-64

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site No. 3 - Salvage Storage Yard

Source Type

______	Landfill	X	Contaminated Soil
______	Surface Impoundment	______	Pile
______	Drums	______	Land Treatment
______	Tanks/Containers	______	Other (leaking pipelines)

Description:

The yard is an open area, approximately 300 by 600 feet, used for the storage of scrap metal, fixtures, and tools. A drum storage area for waste oils and halogenated and non-halogenated solvents formerly existed in the area. The storage yard has been downsized several times since the early 1950s for the expansion of adjacent paved parking areas.

Hazardous Waste Quantity

The quantity of hazardous materials stored/spilled/deposited in the area is not known. The area of the site (300 by 600 feet) is calculated to be 180,000 ft^2.

Hazardous Substances/Physical State

Liquids such as waste oils, halogenated/non-halogenated solvents may have spilled from containers, or dripped from metals items stored in the salvage yard. Inorganic contamination, including heavy metals, may be present due to the nature of the materials stored there.

Ref. No. 6, pp. 64-65

PART III. SAMPLING RESULTS
EXISTING ANALYTICAL DATA

Samples for chemcial analysis were collected for surface and subsurface soil, groundwater, surface water, and sediments during a Phase I Remedial Investigation (RI). All samples were analyzed by a Contract Laboratory Program (CLP) certified laboratory in accordance with CLP protocols.

Analytical results indicated notable levels of organic compounds in the soil, surface water, and groundwater. The highest levels at NWIRP were found in the former drum-marshaling areas (Site No. 1). The surface soils at Site No. 3 (the salvage storage area) exhibited the highest levels of inorganic constituents in the surface soils. Polychlorinated biphenyls (PCB's) were also reported at different locations in the soils of all three sites of NWIRP. It should also be noted that surface water and sediment samples taken from the recharge basins at Site No. 2 possessed levels of organic constituents, mainly chlorinated ethenes.

Ref. No. 7

PART IV. HAZARD ASSESSMENT

GROUNDWATER ROUTE

1. **Describe the likelihood of a release of contaminant(s) to the groundwater as follows: observed release, suspected release, or none. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release, define the supporting analytical evidence.**

   There is an observed release of contaminants to the groundwater beneath the site. Maximum concentrations of the following compounds were detected in groundwater samples collected from monitoring wells: 58 ppm trichloroethylene (HN24I), 3.6 ppm tetrachloroethylene (HN29S), 10 ppm 1,1,1-trichloroethane (HN29S), 880 ppb 1,1-dichloroethane (HN29S), 3.6 ppm 1,2-dichloroethene (HN29S), 392 ppb cadmium (HN27S), 2.69 ppm cyanide (HN27S), 85.7 ppb lead (USGS well), and 169 ppb chromium (HN27S). The highest levels were detected in the drum-marshaling area.

   Ref. No. 7, pp. 4-12 to 4-32

2. **Describe the aquifer of concern; include information such as depth, thickness, geologic composition, areas of karst terrain, permeability, overlying strata, confining layers, interconnections, discontinuities, depth to water table, groundwater flow direction.**

   The site is underlain by Pleistocene outwash sediments ranging from forty to one hundred thirty feet which are known as the Upper Glacial Aquifer. The Upper Glacial Aquifer mainly consists of a highly permeable gravel, known as the Mannetto Gravel. The hydraulic conductivity of the formation is approximately 1.17×10^{-2} cm/sec. The Magothy Formation lies immediately beneath the Upper Glacial aquifer and occurs to a depth of approximately 700 ft. The Magothy is unconfined in the area of the site and primarily contains coarse sand with varied amounts of clay, lignite, and silt. The permeability of the Magothy in the site's area is approximately 2.47×10^{-2} cm/sec. The Magothy is underlain by the a clay member of the Raritan formation and is found to a depth of 860 ft. with a low permeability of approximately 9×10^{-9} cm/sec. Underlying the clay of the Raritan Formation are sands of the Lloyd Sand Member of the Raritan Formation and it is approximately 300 feet thick. Bedrock lies beneath the Lloyd Sand Member and is composed of impermeable schist, gneiss, and granite. Groundwater can be found on site at a depth of 40 feet with groundwater directional flow to the south.

   Ref Nos. 6, pp. 47, 71-78; 7, pp. 3-1 to 3-23

3. **What is the depth from the lowest point of waste disposal/storage to the highest seasonal level of the saturated zone of the aquifer of concern?**

   The depth to groundwater from the ground surface is approximately 40 feet.

   Ref. Nos. 6, pp. 71-78; 7, pp. 3-1 to 3-23

4. **Identify and determine the distance to and depth of the nearest well that is currently used for drinking purposes?**

   The nearest municipal drinking water wells to the site are a group of three wells which are operated by the Bethpage Water Company.

Well Number	Distance	Well Depth
6078	0.75 mile	275
8767	0.75 mile	640
8768	0.75 mile	678

Ref. No. 6, p. 48

5. **If a release to groundwater is observed or suspected, determine the number of people that obtain drinking water from wells that are documented or suspected to be located within the contamination boundary of the release.**

A release to the groundwater is observed but no potable water wells are located within the contamination boundary of suspected release.

Ref. Nos. 6, p. 48

6. **Identify the population served by wells located within 4 miles of the site that draw from the aquifer of concern.**

Distance	Population
0 - ¼ mi	0
>¼ - ½ mi	0
>½ - 1 mi	16,929
>1 - 2 mi	47,174
>2 - 3 mi	125,413
>3 - 4 mi	113,244

State whether groundwater is blended with surface water, groundwater, or both before distribution.

The groundwater is blended with groundwater before distribution.

Ref. No. 6, p. 49

Is there a well head protection area within 4 miles of the site?

The site lies directly within a New York State Department of Environmental Conservation (NYSDEC) designated wellhead protection area.

Ref. No. 3

Does a waste source overlie a designated or proposed wellhead protection area? If a release to groundwater is observed or suspected, does a designated or proposed wellhead protection area lie within the contaminant boundary of the release?

The site overlies a NYSDEC designated wellhead protection area. This designated wellhead protection area does lie within the contaminant boundary of the release.

Ref. No. 3

7. **Identify uses of groundwater within 4 miles of the site (i.e. private drinking source, municipal source, commercial, irrigation, unusable).**

   The groundwater is extensively utilized as a source for potable water within four miles of the site.

   Ref. Nos. 6, pp. 49, 74, 249; 7, pp. 3-7

SURFACE WATER ROUTE

8. **Describe the likelihood of a release of contaminant(s) to surface water as follows: observed release, suspected release, or none. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release, define the supporting analytical evidence.**

   There is an observed release of both organic and inorganic constituents to the surface water associated with NWIRP. Surface water/sediment samples taken from the groundwater recharge basins (isolated surface water bodies) located in Site No. 2 indicate the following maximum concentrations: 35 ppb trichloroethene (SW1), 6 ppb 1,1,1-trichloroethane (SW1), 0.14 ppm mercury (SD100), 27.5 ppm chromium (SD200) 141 ppm copper (SD202), and 0.96 ppm silver (SD202). Storm water, non-contact cooling water and treatment production associated rinse waters discharge to these basins.

   Ref. Nos. 6, pp. 62 - 64; 7, pp. 4-59 - 4-66.

9. **Identify the nearest downslope surface water. If possible, include a description of possible surface drainage patterns from the site.**

   The nearest downslope surface waters are the three groundwater recharge basins located in Site No. 2 of NWIRP. These three large groundwater recharge basins each are approximately 300 x 300 feet in size, with the maximum operating fill level of approximately 15 feet. It is not known if during operations this level was maintained on a continual basis for each basin. Stormwater, non-contact cooling water and treatment production associated rinse waters discharge to these basins.

   Ref. No. 6, pp. 62 - 64, 251

10. **What is the distance in feet to the nearest downslope surface water? Measure the distance along a course that runoff can be expected to follow.**

    The distance to the nearest downslope water is zero feet.

    Ref. No. 6, pp. 49, 249-251

11. **Determine the type of floodplain that the site is located within.**

    The site is located outside the 500-year floodplain.

    Ref. No. 6, pp. 50, 249-251

12. **Identify drinking water intakes in surface waters within 15 miles downstream of the point of surface water entry. For each intake identify: the name of the surface water body in which the intake is located, the distance in miles from the point of surface water entry, population served, and stream flow at the intake location.**

There is a low potential for a contaminant migration to surface water remote from the site property due to the presence of a stormwater management system to collect and divert runoff to groundwater recharge basins. Thus, there are no drinking water intakes in surface waters within fifteen miles downstream of the site which may be potentially effected.

Ref. Nos. 6, pp. 49, 249-251; 7, p. 1-6

13. **Identify fisheries that exist within 15 miles downstream of the point of surface water entry. For each fishery specify the following information:**

There is a low potential for a contaminant migration to surface water remote from the site property due to the presence of a stormwater management system to collect and divert runoff to groundwater recharge basins. Hence, there are no fisheries existing along the surface water pathway that may be potentially effected.

Ref. Nos. 6, pp. 49, 249-251; 7, p. 1-6

14. **Identify surface water sensitive environments that exist within 15 miles of the point of surface water entry.**

There is a low potential for a contaminant migration to surface water remote from the site property due to the presence of a stormwater management system to collect and divert runoff to groundwater recharge basins. Hence, there are no sensitive environments existing along the surface water pathway that may be potentially effected.

Ref. Nos. 5, 6, pp. 49, 249-251; 7, p. 1-6

15. **If a release to surface water is observed or suspected, identify any intakes, fisheries, and sensitive environments from question Nos. 12-14 that are or may be located within the contamination boundary of the release.**

Intake: None

Fishery: None

Environment: None

There is a low potential for a contaminant migration to surface water remote from the site property due to the presence of a stormwater management system to collect and divert runoff to groundwater recharge basins. Therefore, there are no intakes, fisheries, or sensitive environments existing along the surface water pathway which may be potentially effected.

Ref. Nos. 5, 6, pp. 49, 249-251; 7, p. 1-6

SOIL EXPOSURE PATHWAY

16. **Determine the number of people that occupy residences or attend school or day care on or within 200 feet of the site property.**

A total of ninety-seven people occupy residences within 200 feet of the site property. No day care or schools have been identified.

Ref. Nos. 4; 6, pp. 249, 272

17. **Determine the number of people that regularly work on or within 200 feet of the site property.**

Seventy-eight people work at the NWIRP site.

Ref. No. 6, p. 277

18. **Identify terrestrial sensitive environments on or within 200 feet of the site property.**

No known terrestrial sensitive environments occur on or within 200 feet.

Ref. No. 5

AIR ROUTE

19. **Describe the likelihood of release of contaminants to air as follows: observed release, suspected release, or none. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release define the supporting analytical evidence.**

There has been no observed or suspected release of contaminants to the air from the site.

Ref. No. 6, p. 52

20. **Determine populations that reside within 4 miles of the site.**

Distance	Population
0 - ¼ mi	97
>¼ - ½ mi	2,101
>½ - 1 mi	12,718
>1 - 2 mi	58,207
>2 - 3 mi	88,801
>3 - 4 mi	98,545

Ref. No. 2

21. **Identify sensitive environments, including wetlands and associated wetlands acreage, within ½ mile of site.**

0 - ¼ mile	¼ - ½ mile
Sensitive Environments/Wetland Acreage	Sensitive Environments/Wetland Acreage
Wetlands - approximately 2.3 acres	Wetlands - approximately 0.8 acres

There have been rare plants, animals, natural communities, and significant habitats identified in the site's vicinity.

Ref. No. 5, 6, p. 251

22. **If a release to air is observed or suspected, determine the number of people that reside or are suspected to reside within the area of air contamination from the release.**

A release to the air of contaminants from this site has been neither observed nor suspected.

Ref. No. 6, p. 53

23. **If a release to air is observed or suspected, identify any sensitive environments, listed in question No. 21, that are or may be located within the area of air contamination from the release.**

A release to the air of contaminants from this site has been neither observed nor suspected.

Ref. No. 6, p. 53

This Report was conducted under the following USEPA Documentation Procedure

Guidance for Performing Preliminary Assessments Under CERCLA Publication 9345.0-01A

ATTACHMENT 1

REFERENCES

1. U.S. Environmental Protection Agency (EPA), Superfund Program, Comprehensive Environmental Response Compensation Liability Information System (CERCLIS), List 8: Site Event Listing, p. 413, July 31, 1992.

2. Project Note: To Naval Weapons Industrial Reserve Plant (NWIRP) file, from David Kahlenberg, Malcolm Pirnie, Inc. Subject: Four Mile Vicinity Population, September 10, 1992.

3. Telecon Note: Conversation between Kevin Roberts, Division of Water/Groundwater Management, New York State Department of Environmental Conservation (NYSDEC), and Lisa Szegedi, Malcolm Pirnie, Inc., June 18, 1992.

4. Project Note: to Naval Weapons Industrial Reserve Plant (NWIRP) file, from David Kahlenberg, Malcolm Pirnie, Inc., Subject: Resident Population Determination - Soil Pathway, August 20, 1992.

5. Letter from Burrell Buffington, New York Natural Heritage Program, Wildlife Resources Center,Information Services, NYSDEC, to David Kahlenberg, Malcolm Pirnie, Inc., September 15, 1992.

6. Final Hazard Ranking System Preliminary Scoring and Site Inspection Report Form, Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, NWIRP, Bethpage, New York, Halliburton NUS, February 1992.

7. Final Remedial Investigation Report, NWIRP, Bethpage, New York, Volume I, CLEAN Program, Halliburton NUS, May 1992.

8. Final Remedial Investigation Report, NWIRP, Bethpage, New York, Volume II (Appendix A-G) for Volume I, CLEAN Program, Halliburton NUS, May 1992.

9. Final Remedial Investigation Report, NWIRP, Bethpage, New York, Volume III (Appendix H) for Volume I, CLEAN Program, Halliburton NUS, May 1992.

10. Final Remedial Investigation Report, NWIRP, Bethpage, New York, Volume IV (Appendix I) for Volume I, CLEAN Program, Halliburton NUS, May 1992.

REFERENCE NO. 1

SELECTION:
SEQUENCE: REGION, STATE, SITE NAME

EVENTS: ALL

EPA ID NO.	SITE NAME / STREET / CITY / COUNTY CODE AND NAME	STATE ZIP / CONG DIST.	OPRBLE UNIT	EVENT TYPE	EVENT QUAL	ACTUAL START DATE	ACTUAL COMPL DATE	CURRENT EVENT LEAD
NY4210020414	NAVAL FACIL N DIV /ENGINEERING COMMAND		00	DS1			06/01/81	EPA (FUND)
	CAMP HERO MILITARY RESERVATION			PA1	NO FURTHER REMDL ACT PLND	10/01/90	12/28/90	FED. FAC.
	MONTAUK	NY 11954						
	103 SUFFOLK	NY-01						
NY5170022250	NAVAL STATION NY		00	DS1			01/10/89	FED. FAC.
	207 FLUSHING AVE.			PA1	NO FURTHER REMDL ACT PLND		09/27/89	FED. FAC.
	BROOKLYN	NY 11251						
	047 KINGS	NY-10						
NY8170024790	NAVAL UNDERWATER SYSTEMS CENTER		00	DS1			01/10/89	FED. FAC.
	FISHERS ISLAND			PA1	LOWER PRIORITY		09/27/89	FED. FAC.
	FISHER ISLAND	NY 06390						
	103 SUFFOLK	NY-01						
NY0170085559	NAVAL WEAPONS INDUSTRIAL RESERVE PLANT		00	DS1			02/17/87	EPA (FUND)
	WADING RIVER MANOR ROAD			PA1	HIGHER PRIORITY	12/21/88	12/29/88	FED. FAC.
	CALVERTON	NY 11933						
	103 SUFFOLK	NY-01						
NY2170022162	NAVAL WEAPONS INDUSTRIAL RESERVE PLANT		00	DS1			02/17/87	EPA (FUND)
	SOUTH OYSTER BAY ROAD			PA1	HIGHER PRIORITY	12/21/88	12/29/88	FED. FAC.
	BETHPAGE	NY 11714						
	059 NASSAU	NY-04						
NYD098353378	NCC DIV /MALLINCKRODT INC		00	DS1			06/01/81	EPA (FUND)
	HOOK RD			PA1	NO FURTHER REMDL ACT PLND		12/30/87	EPA (FUND)
	ARGYLE	NY 12809						
	115 WASHINGTON	NY-29						
NYD001229350	NELSON GALVANIZING, INC		00	RS1		11/19/90	01/30/91	EPA (FUND)
	11-02 BROADWAY			RV1	CLEAN-UP	02/12/91	11/08/91	RESP. PARTY
	LONG ISLAND CITY	NY 11106						
	081 QUEENS	NY-09						

REFERENCE NO. 2

GSC-TR-32-90-008

DRAFT

PCGEMS
USER'S GUIDE
RELEASE 1.0

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
EXPOSURE EVALUATION DIVISION

Under
Contract No. 68024281
Task No. 2-28
Project Officer: Lynn Delpire
Task Manager: Patricia Harrigan

Prepared by

GENERAL SCIENCES CORPORATION
6100 Chevy Chase Drive
Laurel, Maryland 20707

April 1990

MALCOLM PIRNIE, INC. PROJECT NOTE

To: File
From: David Kahlenberg
Subject: Four mile Vicinity Population

Date: September 10, 1992
Project Number: 8003 088
Site Name: Naval Weapons Industrial Reserve Plant - Bethpage NY

Since PCGEMS does not provide data for the population within 0-1/4 miles of the site; and a house count is not possible in this region based on USGS Topographic maps (Reference No. 5, p. 249); a population of 97 was assumed since it was the only population documentable within the 0-1/4 distance (Ref. No 5, p. 272)

Therefore the total population within a 4 mile vicinity is

Distance	Population
0-1/4 miles	97
1/4-1/2 "	2101
1/2-1 "	12718
1-2 "	58207
2-3 "	88801
3-4 "	98545

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT/BETHPAGE

LATITUDE 40:45:17 LONGITUDE 73:29:39 1980 POPULATION

KM	0.00- 0.4	0.4- 0.8	0.8- 1.6	1.6- 3.2	3.2- 4.8	4.8- 6.4	SECTOR TOTALS
S 1	0	2101	12718	58207	88801	98545	260372
RING TOTALS	0	2101	12718	58207	88801	98545	260372

REFERENCE NO. 3

ARCS II CONTRACT 68-W9-0051
MALCOLM PIRNIE, INC.
RECORD OF TELEPHONE CONVERSATION/AGREEMENT

File No. 8002-062

Date: 6/18/92 Time: 9:28 [ ] AM [ ] PM

[ ] Incoming Call From: ______ Telephone No.

Affiliation: ______

[X] Outgoing Call To: Kevin Roberts (518)-457-6674 Telephone No.

Affiliation: NYSDEC Division of Water, Groundwater Management

Malcolm Pirnie Staff: Lisa Szegedi (609)-860-0100
(Receiving or Calling) Name Telephone No.

Summary of [X] Conversation [ ] Agreement:

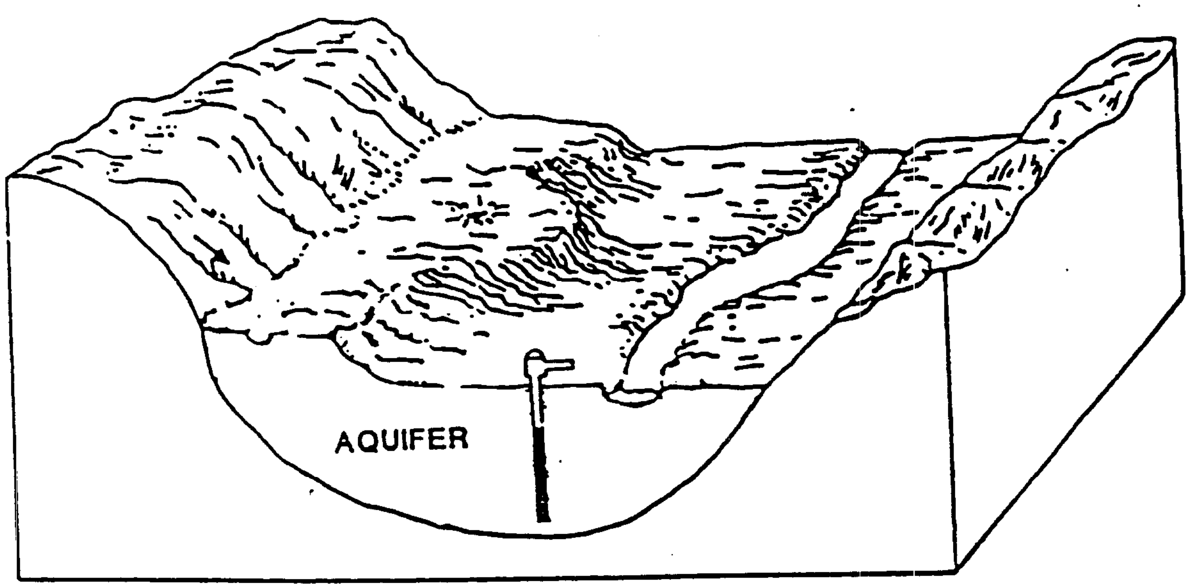
The Sept 1990 NYS wellhead protection program document is a finalized document

f:\rectele.jan(1)

1 of

Department of Environmental Conservation

NEW YORK STATE WELLHEAD PROTECTION PROGRAM



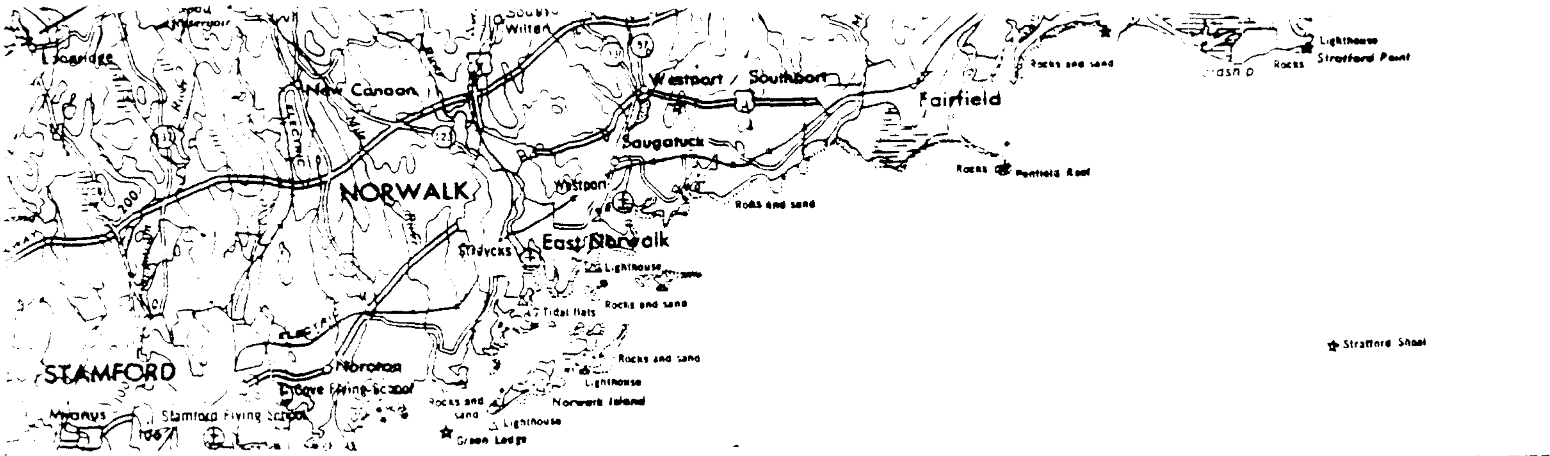
Submittal
to
United States Environmental Protection Agency

New York State Department of Environmental Conservation
MARIO M. CUOMO, *Governor* THOMAS C. JORLING, *Commissioner*

September 1990

TABLE 3.1.
WELLHEAD PROTECTION AREA
DELINEATION SUMMARY

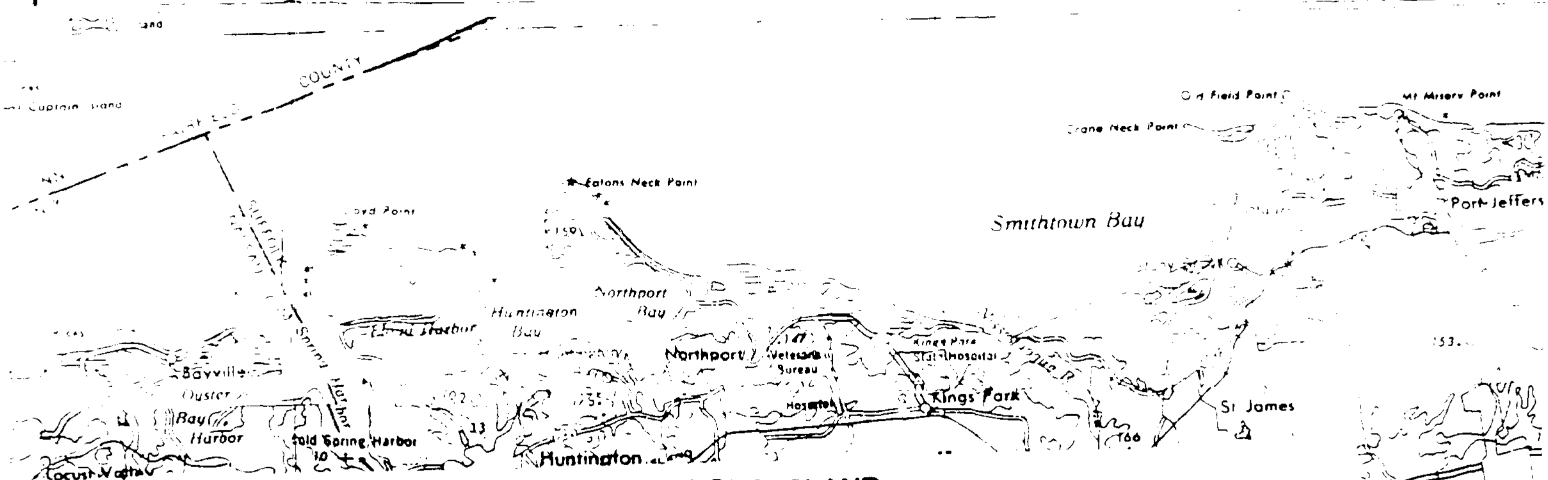
Geographic Region	Aquifer Area	Wellhead Protection Area Baseline Delineation
Long Island	Magothy & Lloyd Aquifers	Deep Flow Recharge Area
	Glacial Aquifer	Simplified Variable Shape: 1,500 ft. radius upgradient 500 ft. radius downgradient
Upstate	Unconsolidated Aquifers	Aquifer Boundaries (land surface)
	Bedrock Aquifers	Fixed Radius: 1,500 ft. radius



POTENTIAL YIELDS OF WELLS IN UNCONSOLIDATED AQUIFERS IN UPSTATE NEW YORK--LOWER HUDSON SHEET

By

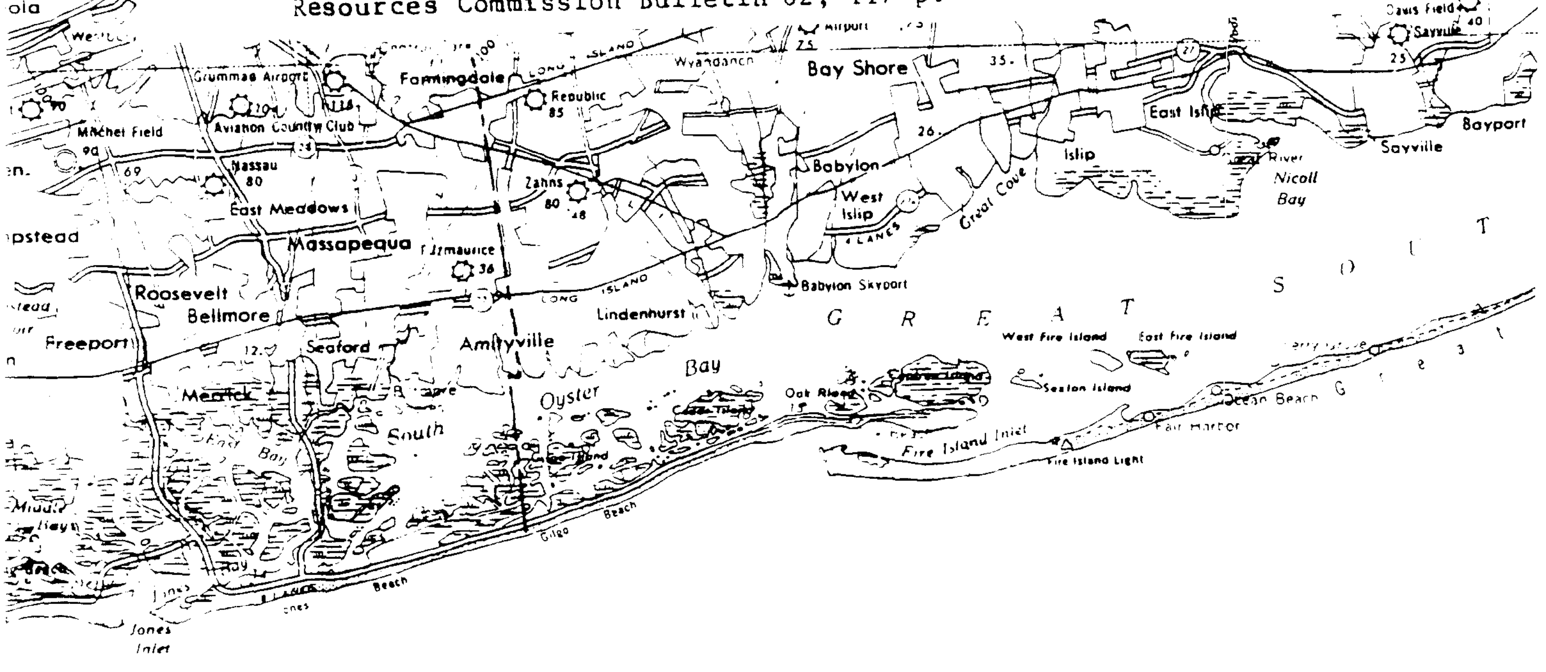
Edward F. Bugliosi and Ruth A. Trudell



LONG ISLAND

Although Long Island's unconsolidated aquifers are not presented on this sheet, the New York State Department of Environmental Conservation has designated the major unconsolidated deposits on Long Island to be Primary aquifers. References and generalized descriptions of these aquifers are given in:

Cohen, Philip, Franke, O. L., and Foxworthy, B. L., 1968, An atlas of Long Island's water resources: New York State Water Resources Commission Bulletin 62, 117 p.



REFERENCE NO. 4

MALCOLM PIRNIE, INC. PROJECT NOTES

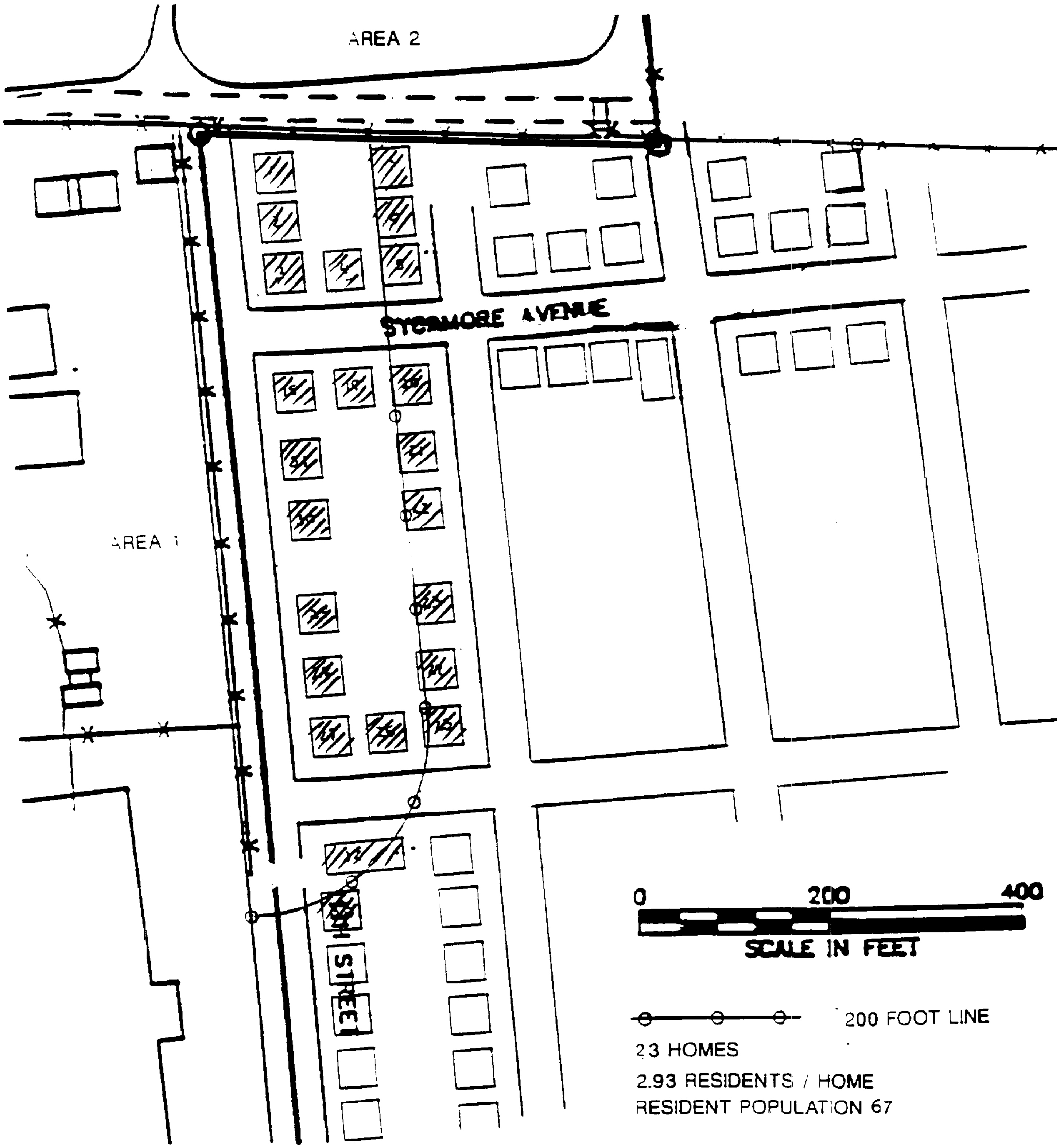
To: FILE
Date: August 30, 1992
From: David Kallenberg
Project Number: 8003-088
Subject: Resident Population Determination - Soil Pathway
Site Name: Naval Weapons Ind. Res. Plant Bethpage, NY

Review of the surface soil analysis results from the Final Remedial Investigation Report for Naval Weapons Industrial Reserve Plant (NWIRP) in Bethpage, New York prepared by Halliburton NUS (May 1992) indicated the presence of organic constituents in the former drum marshalling area (site 1) of the NWIRP site (see pp. 4-36, 4-37, 4-69) a two-hundred foot area of suspected contamination was delineated. It was determined that 23 homes reside within this area, with a Nassau County average household population of 2.94, results in a resident population for the soil exposure pathway of 67.

Table 6. Household, Family, and Group Quarters Characteristics: 1990

[For definitions of terms and meanings of symbols, see text]

State County Place and [In Selected States] County Subdivision	Persons in households	All households	Family households: Total	Family households: Married-couple family	Family households: Female householder, no husband present	Nonfamily households: Total	Nonfamily households: Householder living alone: Total	Householder living alone: 65 years and over: Total	Householder living alone: 65 years and over: Female	Persons per—: Household	Persons per—: Family	Persons in group quarters: Total	Persons in group quarters: Institutionalized persons	Othe…
The State	**17 445 190**	**6 639 322**	**4 489 312**	**3 315 845**	**919 266**	**2 150 010**	**1 806 263**	**700 016**	**544 755**	**2.63**	**3.22**	**545 265**	**267 122**	**271**
COUNTY														
Albany County	278 399	115 824	71 455	54 534	13 355	44 369	35 050	13 559	10 777	2.40	3.04	14 195	4 286	
Allegany County	45 639	17 011	12 318	10 231	1 466	4 693	3 943	1 927	1 478	2.68	3.15	4 831	398	
Bronx County	1 163 368	424 112	288 609	146 234	118 610	135 503	119 218	46 431	35 780	2.74	3.35	40 421	28 534	
Broome County	204 344	81 843	54 819	44 163	8 183	27 024	22 037	9 065	7 203	2.50	3.05	7 816	3 420	
Cattaraugus County	80 833	30 456	21 657	17 395	3 228	8 799	7 543	3 651	2 789	2.65	3.18	3 401	1 035	
Cayuga County	77 968	29 075	20 927	16 660	3 127	8 148	6 874	3 418	2 680	2.68	3.19	4 345	3 955	
Chautauqua County	136 558	53 696	37 203	29 942	5 506	16 493	14 035	6 849	5 459	2.54	3.07	5 337	2 557	
Chemung County	90 460	35 275	24 808	19 646	4 058	10 467	8 992	4 387	3 505	2.56	3.08	4 735	3 788	
Chenango County	50 896	19 141	13 821	11 438	1 670	5 320	4 451	2 085	1 602	2.66	3.14	872	840	
Clinton County	77 971	29 123	20 839	17 279	2 594	8 284	6 429	2 626	2 111	2.68	3.14	7 998	4 282	
Columbia County	60 884	23 696	16 882	13 658	2 339	6 814	5 689	2 759	2 078	2.57	3.04	2 098	1 825	
Cortland County	45 664	17 247	11 799	9 461	1 681	5 448	4 070	1 860	1 513	2.65	3.13	3 299	510	
Delaware County	45 233	17 646	12 374	10 224	1 552	5 272	4 458	2 308	1 746	2.56	3.07	1 992	660	
Dutchess County	240 984	89 567	64 757	53 635	8 353	24 810	19 884	7 705	6 051	2.69	3.18	18 478	11 475	
Erie County	944 115	376 994	254 472	192 646	49 968	122 522	105 083	45 370	35 665	2.50	3.09	24 417	13 138	1
Essex County	34 824	13 721	9 498	7 805	1 204	4 223	3 520	1 682	1 280	2.54	3.07	2 328	2 223	
Franklin County	42 549	16 284	11 265	8 976	1 677	5 019	4 197	2 064	1 612	2.61	3.16	3 991	3 012	
Fulton County	53 276	20 995	14 602	11 601	2 242	6 393	5 412	2 894	2 281	2.54	3.05	915	700	
Genesee County	58 858	21 614	16 050	13 269	2 054	5 564	4 671	2 312	1 840	2.72	3.19	1 202	800	
Greene County	42 080	16 596	11 642	9 465	1 612	4 954	4 245	2 033	1 488	2.54	3.05	2 659	2 474	
Hamilton County	5 197	2 153	1 508	1 266	170	645	550	241	172	2.41	2.89	82	82	
Herkimer County	64 636	24 936	17 576	14 347	2 369	7 360	6 246	3 402	2 594	2.59	3.11	1 161	840	
Jefferson County	103 614	37 851	28 163	23 155	3 680	9 688	8 005	3 772	2 996	2.74	3.19	7 329	2 589	
Kings County	2 266 401	828 199	555 284	335 295	177 871	272 915	236 977	92 972	71 504	2.74	3.40	34 263	16 651	
Lewis County	26 475	9 253	7 056	5 985	744	2 197	1 889	964	728	2.86	3.32	321	307	
Livingston County	56 777	21 197	15 178	12 558	1 896	6 019	4 643	2 043	1 610	2.68	3.14	5 595	2 212	
Madison County	64 006	23 567	17 162	14 137	2 176	6 405	5 050	2 326	1 808	2.72	3.17	5 114	776	
Monroe County	691 387	271 944	182 813	140 622	34 008	89 131	71 166	25 702	20 400	2.54	3.11	22 581	8 405	
Montgomery County	50 956	20 185	14 028	11 058	2 202	6 157	5 432	3 081	2 408	2.52	3.06	1 025	960	
Nassau County	1 266 740	431 515	344 502	286 638	43 950	87 013	73 804	35 544	28 221	2.94	3.30	20 608	9 799	
New York County	1 428 973	716 422	301 041	187 016	92 055	415 381	348 134	87 139	64 439	1.99	2.99	58 563	13 988	
Niagara County	216 912	84 809	59 732	47 221	9 822	25 077	22 119	10 080	7 797	2.56	3.10	3 844	2 358	
Oneida County	236 328	92 562	63 735	50 430	10 385	28 827	24 950	11 640	9 110	2.55	3.12	14 508	9 522	
Onondaga County	453 012	177 898	118 575	91 978	21 081	59 323	47 047	18 082	14 374	2.55	3.12	15 961	5 859	
Ontario County	92 094	34 929	25 143	20 792	3 210	9 786	7 716	3 414	2 675	2.64	3.10	3 007	1 497	
Orange County	293 491	101 506	77 111	63 207	10 401	24 395	19 975	8 404	6 611	2.89	3.35	14 156	6 211	
Orleans County	39 588	14 428	10 685	8 608	1 484	3 743	3 119	1 482	1 146	2.74	3.20	2 258	2 053	
Oswego County	116 928	42 434	30 905	25 013	4 231	11 529	9 150	4 027	3 158	2.76	3.22	4 843	899	
Otsego County	55 592	21 725	14 768	12 258	1 795	6 957	5 414	2 679	2 056	2.56	3.06	4 925	746	
Putnam County	82 838	28 094	22 549	19 675	2 028	5 545	4 410	1 594	1 202	2.95	3.32	1 103	299	
Queens County	1 924 375	720 149	490 915	351 675	102 674	229 234	196 008	82 433	65 305	2.67	3.25	27 223	18 938	
Rensselaer County	148 564	57 612	39 356	30 925	6 446	18 256	14 715	6 211	4 881	2.58	3.13	5 865	1 538	
Richmond County	371 574	130 519	99 059	78 198	16 249	31 460	27 314	10 516	8 305	2.85	3.33	7 403	5 222	
Rockland County	257 325	84 874	66 583	55 520	8 357	18 291	15 067	6 038	4 838	3.03	3.46	8 150	4 994	
St. Lawrence County	101 384	37 964	26 784	21 809	3 663	11 180	8 924	4 223	3 303	2.67	3.16	10 590	3 232	
Saratoga County	177 151	66 425	48 363	40 835	5 597	18 062	14 204	5 263	4 073	2.67	3.14	4 125	2 224	
Schenectady County	144 981	59 181	39 702	31 284	6 556	19 479	16 611	7 649	6 063	2.45	3.01	4 304	2 201	
Schoharie County	29 759	11 257	8 127	6 705	1 016	3 130	2 522	1 249	916	2.64	3.10	2 100	450	
Schuyler County	18 176	6 818	5 025	4 140	618	1 793	1 471	753	571	2.67	3.11	486	474	
Seneca County	32 452	12 285	8 998	7 421	1 156	3 287	2 708	1 296	981	2.64	3.09	1 231	670	
Steuben County	97 128	37 299	26 447	21 446	3 615	10 852	9 194	4 286	3 374	2.60	3.11	1 960	1 690	
Suffolk County	1 292 470	424 719	340 593	282 081	44 113	84 126	67 834	29 961	23 450	3.04	3.40	29 394	16 882	
Sullivan County	63 858	24 576	17 090	13 848	2 344	7 486	6 216	2 916	2 095	2.60	3.13	5 419	2 829	
Tioga County	51 974	18 838	14 470	12 192	1 640	4 368	3 670	1 594	1 252	2.76	3.17	363	318	
Tompkins County	82 093	33 338	19 049	15 488	2 661	14 289	9 066	2 608	2 105	2.46	2.98	12 004	648	
Ulster County	156 774	60 807	42 213	33 839	6 186	18 594	14 799	5 988	4 628	2.58	3.09	8 530	3 653	
Warren County	58 122	22 559	15 788	12 740	2 254	6 771	5 519	2 591	2 070	2.58	3.09	1 087	513	
Washington County	55 682	20 256	15 023	12 218	2 032	5 233	4 295	2 160	1 649	2.75	3.21	3 648	3 519	
Wayne County	87 841	31 977	23 961	19 787	3 046	8 016	6 443	2 948	2 354	2.75	3.17	1 282	962	
Westchester County	845 770	320 030	227 827	180 205	37 133	92 203	79 330	33 373	26 725	2.64	3.16	29 096	16 022	
Wyoming County	38 731	13 897	10 528	8 857	1 175	3 369	2 847	1 391	1 088	2.79	3.23	3 776	3 709	
Yates County	22 158	8 419	6 100	5 111	698	2 319	1 909	996	782	2.63	3.09	652	269	
PLACE AND COUNTY SUBDIVISION														
Adams village, Jefferson County	1 742	726	469	379	78	257	231	131	112	2.40	3.04	11	11	
Adams town, Jefferson County	4 966	1 839	1 335	1 115	177	504	424	220	183	2.70	3.20	11	11	
Adams Center CDP, Jefferson County	1 675	591	455	378	64	136	102	45	36	2.83	3.22	-	-	
Addison village, Steuben County	1 842	711	505	378	94	206	171	106	87	2.59	3.05	-	-	
Addison town, Steuben County	2 645	995	730	556	127	265	215	118	97	2.66	3.08	-	-	
Afton village, Chenango County	838	337	238	207	26	99	86	52	38	2.49	3.01	-	-	
Afton town, Chenango County	2 972	1 092	814	670	98	278	219	108	81	2.72	3.13	-	-	
Airmont CDP, Rockland County	7 540	2 282	2 042	1 817	169	240	196	97	77	3.30	3.51	295	216	
Akron village, Erie County	2 895	1 185	790	621	137	395	350	224	176	2.44	3.04	11	-	
Alabama town, Genesee County	1 998	678	545	468	48	133	118	59	42	2.95	3.30	-	-	
Albany city, Albany County	91 458	42 121	20 308	12 695	6 193	21 813	16 239	5 659	4 481	2.17	2.94	9 624	2 338	
Albertson CDP, Nassau County	5 166	1 808	1 484	1 261	153	324	291	177	150	2.86	3.21	-	-	
Albion village, Orleans County	5 710	2 317	1 504	1 061	347	813	704	350	284	2.46	3.06	153	121	
Albion town, Orleans County	6 259	2 394	1 625	1 211	316	769	659	319	249	2.61	3.19	1 919	1 887	
Albion town, Oswego County	2 028	638	528	442	54	110	81	26	12	3.18	3.45	15	15	
Alden village, Erie County	2 443	955	667	558	77	288	251	134	103	2.56	3.13	14	-	
Alden town, Erie County	8 587	2 991	2 411	2 100	226	580	491	259	200	2.87	3.25	1 785	1 771	
Alexander village, Genesee County	445	150	123	102	12	27	23	14	13	2.97	3.28	-	-	
Alexander town, Genesee County	2 233	742	621	543	47	121	99	41	33	3.01	3.28	-	-	
Alexandria town, Jefferson County	3 899	1 505	1 091	878	133	414	345	186	139	2.59	3.05	50	21	
Alexandria Bay village, Jefferson County	1 154	504	309	222	64	195	171	95	76	2.29	2.94	40	21	
Alfred village, Allegany County	1 055	487	191	177	12	296	197	59	52	2.17	2.81	3 504	-	
Alfred town, Allegany County	2 287	958	517	460	36	441	308	87	76	2.39	3.02	3 504	-	
Allegany village, Cattaraugus County	1 944	754	459	383	57	295	193	114	91	2.58	3.06	36	36	
Allegany town, Cattaraugus County	6 410	2 399	1 720	1 464	196	679	520	266	209	2.67	3.12	1 917	36	
Allegany Reservation, Cattaraugus County	1 139	419	289	187	82	130	107	44	31	2.72	3.30	4	-	
Allen town, Allegany County	406	137	109	99	6	28	26	14	8	2.96	3.40	-	-	
Alma town, Allegany County	838	293	240	210	17	53	45	28	15	2.86	3.16	8	8	
Almond village	458	185	133	108	22	52	47	27	21	2.48	3.00	-	-	
Allegany County	442	175	128	103	22	47	43	25	20	2.53	3.04	-	-	
Steuben County	16	10	5	5	-	5	4	2	1	1.60	2.00	-	-	



RESIDENT POPULATION CALCULATION

REFERENCE NO. 5

New York State Department of Environmental Conservation

Wildlife Resources Center
Information Services
700 Troy-Schenectady Road
Latham, New York 12110-2400

Thomas C. Jorling
Commissioner

September 15, 1992

David Kahlenberg
Malcolm Pirnie
104 Interchange Plaza
Cranbury, New Jersey 08512-9543

Dear Mr. Kahlenberg:

We have reviewed the New York Natural Heritage Program files with respect to your request for biological information concerning the Naval Weapons Industrial Reserve Plant Superfund site, as indicated on your map, located in the Town of Oyster Bay, Nassau County, New York State.

Enclosed is a computer printout covering the area you requested to be reviewed by our staff. The information contained in this report is <u>confidential</u> and may not be released to the public without permission from the New York Natural Heritage Program.

Our files are continually growing as new habitats and occurrences of rare species and communities are discovered. In most cases, site-specific or comprehensive surveys for plant and animal occurrences have not been conducted. For these reasons, we can only provide data which have been assembled from our files. We cannot provide a definitive statement on the presence or absence of species, habitats or natural communities. This information should <u>not</u> be substituted for on-site surveys that may be required for environmental assessment.

This response applies only to known occurrences of rare animals, plants and natural communities and/or significant wildlife habitats. You should contact our regional office, Division of Regulatory Affairs, at the address <u>enclosed</u> for information regarding any regulated areas or permits that may be required (e.g., regulated wetlands) under State Law.

If this project is still active one year from now we recommend that you contact us again so that we may update this response.

Sincerely,

Burrell Buffington

Burrell Buffington
NY Natural Heritage Program

Encs.
cc: Reg. 1, Wildlife Mgr.
Reg. 1, Fisheries Mgr.

REFERENCE NO. 6

R-51-2-2-6

FINAL
HAZARD RANKING SYSTEM
PRELIMINARY SCORING AND
SITE INSPECTION REPORT FORM

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN)
PROGRAM

NAVAL WEAPONS INDUSTRIAL
RESERVE PLANT
BETHPAGE, NEW YORK

NORTHERN AND CHESAPEAKE DIVISIONS

CONTRACT NUMBER N62472-90-D-1298

CONTRACT TASK ORDER 0032

FEBRUARY 1992

HALLIBURTON NUS
Environmental Corporation

R-51-2-2-6

FINAL
HAZARD RANKING SYSTEM PRELIMINARY SCORING AND SITE INSPECTION REPORT FORM

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

SUBMITTED TO:
NORTHERN DIVISION, ENVIRONMENTAL BRANCH, CODE 1423/FK
NAVAL FACILITIES ENGINEERING COMMAND
BUILDING 77-L, U.S. NAVAL BASE
PHILADELPHIA, PENNSYLVANIA 19112-5094

SUBMITTED BY:
HALLIBURTON NUS ENVIRONMENTAL CORPORATION
999 WEST VALLEY ROAD
WAYNE, PENNSYLVANIA 19087

CONTRACT NUMBER N62472-90-D-1298

CONTRACT TASK ORDER 0032

FEBRUARY 1992

PREPARED BY:	APPROVED FOR SUBMISSION BY:
David L. Brayack	John Trepanowski
DAVID BRAYACK, P.E.	JOHN TREPANOWSKI, P.E.
PROJECT MANAGER	PROGRAM MANAGER

2

OMB Approval Number: 2050-
Approved for Use Through:

PA SCORESHEETS

Site Name: NWIRP BETHPAGE
CERCLIS ID No.: NY217022162
Street Address:
City/State/Zip: BETHPAGE, NY 11714

Investigator: RANDY PATARCITY
Agency/Organization: HALLIBURTON NUS
Street Address: 999 WEST VALLEY ROAD
City/State: WAYNE, PA

Date: 02/04/92

Ground Water Pathway Criteria List
Primary Targets

Is any drinking water well nearby? (y/n/u)	Y
Has any nearby drinking water well been closed? (y/n/u)	N
Has any nearby drinking water well user reported foul-testing or foul-smelling water? (y/n/u)	N
Does any nearby well have a large drawdown/high production rate? (y/n/u)	Y
Is any drinking water well located between the site and other wells that are suspected to be exposed to a hazardous substance? (y/n/u)	N
Does analytical or circumstantial evidence suggest contamination at a drinking water well? (y/n/u)	N
Does any drinking water well warrant sampling? (y/n/u)	N
Other criteria? (y/n) N	
PRIMARY TARGET(S) IDENTIFIED? (y/n)	N

Summarize the rationale for Primary Targets:

NO DRINKING WATER WELLS USED BY THE MUNICIPAL SUPPLIERS SURROUNDING THE SITE ARE KNOWN TO HAVE BEEN CLOSED BECAUSE OF CONTAMINATION RELATED TO THE FACILITY.

GROUND WATER PATHWAY SCORESHEETS

Pathway Characteristics		Ref.
Do you suspect a release? (y/n)	Yes	
Is the site located in karst terrain? (y/n)	No	1,2
Depth to aquifer (feet):	45	1,2
Distance to the nearest drinking water well (feet):	4000	6,7

LIKELIHOOD OF RELEASE	Suspected Release	No Suspected Release	References
1. SUSPECTED RELEASE	550		
2. NO SUSPECTED RELEASE		0	
LR =	550	0	

Targets

TARGETS	Suspected Release	No Suspected Release	References
3. PRIMARY TARGET POPULATION 0 person(s)	0		
4. SECONDARY TARGET POPULATION Are any wells part of a blended system? (y/n) Y	4889	0	
5. NEAREST WELL	9	0	
6. WELLHEAD PROTECTION AREA None within 4 Miles	0	0	
7. RESOURCES	5	0	
T =	4903	0	

WASTE CHARACTERISTICS		
WC =	18	0

GROUND WATER PATHWAY SCORE:
100

Ground Water Target Populations

Primary Target Population Drinking Water Well ID	Dist. (miles)	Population Served	Reference	Value
None				
			Total	

Secondary Target Population Distance Categories	Population Served	Reference	Value
0 to 1/4 mile	0	6,7	0
Greater than 1/4 to 1/2 mile	0	6,7	0
Greater than 1/2 to 1 mile	16929	6,7	522
Greater than 1 to 2 miles	47174	6,7	939
Greater than 2 to 3 miles	125413	6,7	2122
Greater than 3 to 4 miles	113244	6,7	1306
		Total	4889

15

Apportionment Documentation for a Blended System

BETHPAGE WD: 4 WELLS-16929 RES. IN 0.5-1 MI., 5 WELLS-16071 RES. IN 1-2 MILES
LEVITTOWN WD: 7 WELLS-42600 RES. IN 2-3 MI., 2 WELLS-7400 RES. IN 3-4 MILES
PLAINVIEW WD: 4 WELLS-10989 RES. IN 1-2 MI., 6 WELLS-24011 RES. IN 2-3 MILES
HICKSVILLE WD: 4 WELLS-20114 RES. IN 1-2 MI., 8 WELLS-27700 RES. IN 2-3 MILES
E MEADOW WD: 2 WELLS-7862 RES. IN 3-4 MILES
BOWLING GREEN WD: 2 WELLS-12000 RES. IN 3-4 MILES
S FARMINGDALE WD: 6 WELLS-25747 RES. IN 2-3 MI., 3 WELLS-17478 RES. IN 3-4 MILES
FARMINGDALE VILLAGE: 2 WELLS-5355 RES. IN 2-3 MI., 1 WELL-3091 RES. IN 3-4 MILES
NY WATER-MERRICK: 2 WELLS-35301 RES. IN 3-4 MILES
WESTBURY WD: 1 WELL-38 RES. IN 3-4 MILES
JERICHO WD: 4 WELLS-16794 RES. IN 3-4 MILES
S HUNTINGTON WD: 3 WELLS-11935 RES. IN 3-4 MILES
E FARMINGDALE WD: 2 WELLS-1345 RES. IN 3-4 MILES
NO PRIVATE HOME WELLS ARE KNOWN TO EXIST IN A 4-MILE RADIUS

OMB Approval Number: 2050-00
Approved for Use Through: 1/

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: NY	CERCLIS Number NY217022162
	CERCLIS Discovery Date: UNKNOWN	

1. General Site Information

Name: NWIRP BETHPAGE			Street Address:			
City: BETHPAGE	State: NY		Zip Code: 11714	County: NASSAU	Co. Code: 059	Cong Dist
Latitude: 40 45' 17.0"	Longitude: 73 29' 38.0"	Approx. Area of Site: 0 sq feet		Status of Site: Active		

2. Owner/Operator Information

Owner			Operator		
Owner: COMNAVAIRSYSCOM			Operator: GRUMMAN AEROSPACE CORPORATION		
Street Address: JEFFERSON PLAZA 2, ROOM 528			Street Address:		
City: WASHINGTON			City: BETHPAGE		
State: DC	Zip Code: 20361	Telephone:	State: NY	Zip Code: 11714	Telephone:
Type of Ownership: Private			How Initially Identified: Not Specified		

4

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION	
	State: NY	CERCLIS Number NY217022162
	CERCLIS Discovery Date: UNKNOWN	

3. Site Evaluator Information

Name of Evaluator: RANDY PATARCITY	Agency/Organization: HALLIBURTON NUS	Date Prepared: 02/04/92
Street Address: 999 WEST VALLEY ROAD	City: WAYNE	State PA
Name of EPA or State Agency Contact: FRANK KLANCHAR (USN)	Telephone: (215) 897-6280	
Street Address: NAVFACENGCOM BLDG 77-L	City: PHILADELPHIA	State PA

4. Site Disposition (for EPA use only)

Emergency Response/Removal Assessment Recommendation: No Date:	CERCLIS Recommendation: Higher Priority SI Date:	Signature: Name: Position:

5

POTENTIAL HAZARDOUS

WASTE SITE

PRELIMINARY ASSESSMENT FORM

IDENTIFICATION

State: NY | CERCLIS Number NY217022162

CERCLIS Discovery Date: UNKNOWN

5. General Site Characteristics

Predominant Land Uses Within 1 Mile of Site:
- Industrial
- Commercial
- Residential
- DOD

Site Setting:
Urban

Years of Operation:
Beginning Year: 1933
Ending Year: 1992

Type of Site Operations:
- Manufacturing
  - Industrial Organic Chemicals
  - Metal Coatings, Plating, Engraving
  - Metal Forging, Stamping
  - Fabricated Structural Metal Products
  - Electronic Equipment
- Junk/Salvage Yard
- DOD
- RCRA
  - Large Quantity Generator

Waste Generated:
Onsite

Waste Deposition Authorized By: Present Owner

Waste Accessible to the Publi
No

Distance to Nearest Dwelling, School, or Workplace:
75 Feet

6. Waste Characteristics Information

Source Type	Quantity	Tier
Contaminated soil	1.60e+05 sq ft	A
Contaminated soil	2.70e+05 sq ft	A
Contaminated soil	9.00e+04 sq ft	A
Contaminated soil	2.40e+05 sq ft	A

Tier Legend
C = Constituent W = Wastestream
V = Volume A = Area

General Types of Waste:
- Metals
- Organics
- Inorganics
- Solvents
- Paints/Pigments
- Oily Waste

Physical State of Waste as Deposit
- Liquid
- Sludge

6

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION
	State: NY
	CERCLIS Numbe NY217022162
	CERCLIS Discovery Date UNKNOWN

7. Ground Water Pathway

Is Ground Water Used for Drinking Water Within 4 Miles:
Yes

Type of Ground Water Wells Within 4 Miles:
Municipal

Depth to Shallowest Aquifer:
45 Feet

Karst Terrain/Aquifer Present:
No

Is There a Suspected Release to Ground Water:
Yes

Have Primary Target Drinking Water Wells Been Identified: No

Nearest Designated Wellhead Protection Area:
None within 4 Miles

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - 1/4 Mile	
>1/4 - 1/2 Mile	
>1/2 - 1 Mile	1692
>1 - 2 Miles	4717
>2 - 3 Miles	12541
>3 - 4 Miles	11324
Total	30276

7

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION State: NY CERCLIS Number: NY217022162 CERCLIS Discovery Date: UNKNOWN

8. Surface Water Pathway — Part 1 of 4

Type of Surface Water Draining Site and 15 Miles Downstream:	Shortest Overland Distance From Any Source to Surface Water:
Other: NONE	17424 Feet 3.3 Miles
Is there a Suspected Release to Surface Water: No	Site is Located in: > 500 yr floodplain

. Surface Water Pathway — Part 2 of 4

Drinking Water Intakes Along the Surface Water Migration Path: No

Have Primary Target Drinking Water Intakes Been Identified: No

Secondary Target Drinking Water Intakes:
None

8

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION
	State: NY / CERCLIS Number NY217022162
	CERCLIS Discovery Date: UNKNOWN

8. Surface Water Pathway — Part 3 of 4

Fisheries Located Along the Surface Water Migration Path: No

Have Primary Target Fisheries Been Identified: No

Secondary Target Fisheries:
None

8. Surface Water Pathway — Part 4 of 4

Wetlands Located Along the Surface Water Migration Path? (y/n) No

Have Primary Target Wetlands Been Identified? (y/n) No

Secondary Target Wetlands:
None

Other Sensitive Environments Along the Surface Water Migration Path: No

Have Primary Target Sensitive Environments Been Identified: No

Secondary Target Sensitive Environments:
None

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM	IDENTIFICATION
	State: NY / CERCLIS Number NY217022162
	CERCLIS Discovery Date: UNKNOWN

9. Soil Exposure Pathway

Are People Occupying Residences or Attending School or Daycare on or Within 200 Feet of Areas of Known or Suspected Contamination: Yes
Total Resident Population: 97

Number of Workers Onsite: 1 - 100

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination: No

10. Air Pathway

Total Population on or Within:	
Onsite	78
0 - 1/4 Mile	602
>1/4 - 1/2 Mile	901
>1/2 - 1 Mile	11020
>1 - 2 Miles	62034
>2 - 3 Miles	73605
>3 - 4 Miles	88015
Total	236255

Is There a Suspected Release to Air: No

Wetlands Located Within 4 Miles of the Site: No

Other Sensitive Environments Located Within 4 Miles of the Site: No

Sensitive Environments Within 1/2 Mile of the Site:
None

WASTE CHARACTERISTICS

Waste Characteristics (WC) Calculations:

1 DRUM MARSHALL. AREA Contaminated soil Ref: 1,2 WQ value maximum

Area 1.60E+05 sq ft 4.71E+00 4.71E+0
SITE 1 FORMER DRUM MARSHALLING AREA AND ADJACENT YARD IS APPROX. 400 FEET BY 400 FEET. A SEPTIC SYSTEM LEACH FIELD CONNECTED TO PLANT NO. 3 WAS FORMERLY LOCATED BENEATH THIS AREA.

2 RECHARGE BASINS Contaminated soil Ref: 1,2 WQ value maximum

Area 2.70E+05 sq ft 7.94E+00 7.94E+0
SITE 2 THREE RECHARGE BASINS LOCATED AT SITE 2 ARE EACH APPROX. 300 FEET BY 300 FEET IN AREA. THE BASINS RECEIVED CONTACT COOLING WATER AND OTHER INDUSTRIAL DISCHARGES FROM PLANT NO. 3 IN PAST YEARS.

3 SLUDGE DRYING BEDS Contaminated soil Ref: 1,2 WQ value maximum

Area 9.00E+04 sq ft 2.65E+00 2.65E+0
SITE 2 AN AREA FORMERLY USED TO AS A DRYING AREA FOR INDUSTRIAL WASTEWATER TREATMENT PLANT SLUDGES IS LOCATED ADJACENT TO THE RECHARGE BASINS. THE AREA IS APPROX. 300 FEET BY 300 FEET. THE WATER CONTAINED IN THE SLUDGES WAS ALLOWED TO INFILTRATE INTO THE SOIL.

4 SALVAGE STORAGE AREA Contaminated soil Ref: 1,2 WQ value maximum

Area 2.40E+05 sq ft 7.06E+00 7.06E+0
SITE 3 THE SALVAGE STORAGE YARD HAS BEEN USED FOR THE STORAGE OF WASTE AND RECYCLEABLE METALS. OILS AND SOLVENTS RELATED TO METAL FINISHING ACTIVITIES MAY HAVE DRIPPED FROM THE SCRAP MATERIAL TO THE SOIL SURFACE. THE APPROX. ORIGINAL AREA OF THE STORAGE YARD IS 600 FEET BY 400 FEET. PORTIONS OF THE SALVAGE STORAGE YARD HAVE BEEN PAVED FOR USE AS PARKING LOTS.

WQ total 2.24E+0

| Waste Characteristics Score: WC = 1

Ground Water Pathway Criteria List
Suspected Release

Are sources poorly contained? (y/n/u)	Y
Is the source a type likely to contribute to ground water contamination (e.g., wet lagoon)? (y/n/u)	Y
Is waste quantity particularly large? (y/n/u)	U
Is precipitation heavy? (y/n/u)	N
Is the infiltration rate high? (y/n/u)	Y
Is the site located in an area of karst terrain? (y/n)	N
Is the subsurface highly permeable or conductive? (y/n/u)	Y
Is drinking water drawn from a shallow aquifer? (y/n/u)	Y
Are suspected contaminants highly mobile in ground water? (y/n/u)	Y
Does analytical or circumstantial evidence suggest ground water contamination? (y/n/u)	Y
Other criteria? (y/n) N	
SUSPECTED RELEASE? (y/n)	Y

Summarize the rationale for Suspected Release:

SAMPLING OF GROUNDWATER BY HALLIBUTON NUS IN SEPTEMBER AND DECEMBER OF 1991 INDICATED THE PRESENCE OF CONTAMINATION IN THE GROUNDWATER AND SOILS OF THE STUDIED SITES. CONTAMINANTS FOUND IN SITE 1 GROUNDWATER INCLUDE 1,1,1-TRICHLOROETHANE (UP TO 10000 UG/L), TETRACHLOROETHANE (UP TO 3600 UG/L), AND 1,2-DICHLOROETHENE (UP TO 3600 UG/L). CONTAMINANTS IDENTIFIED IN SITE 2 GROUNDWATER INCLUDE TRACE LEVELS OF TCE, AND TCE (UP TO 35 UG/L) IN THE RECHARGE BASIN WATERS. CONTAMINANTS IDENTIFIED IN SITE 3 GROUNDWATER INCLUDE TCE (UP TO 120 UG/L), 1,2-DCE (UP TO 100 UG/L), AND TETRACHLOROETHANE (up to 75 ug/l).
TCE WAS FOUND IN WELL HN-24-I AT 58000 UG/L.

Surface Water Pathway Criteria List
Suspected Release

Is surface water nearby? (y/n/u)

Is waste quantity particularly large? (y/n/u)

Is the drainage area large? (y/n/u)

Is rainfall heavy? (y/n/u)

Is the infiltration rate low? (y/n/u)

Are sources poorly contained or prone to runoff or flooding? (y/n/u)

Is a runoff route well defined(e.g.ditch/channel to surf.water)? (y/n/u)

Is vegetation stressed along the probable runoff path? (y/n/u)

Are sediments or water unnaturally discolored? (y/n/u)

Is wildlife unnaturally absent? (y/n/u)

Has deposition of waste into surface water been observed? (y/n/u)

Is ground water discharge to surface water likely? (y/n/u)

Does analytical/circumstantial evidence suggest S.W. contam? (y/n/u)

Other criteria? (y/n) N

SUSPECTED RELEASE? (y/n)

Summarize the rationale for Suspected Release:

NO RELEASE OF CONTAMINANTS VIA THE SURFACE WATER PATHWAY HAS OCCURRED AT THE SITE. NO DIRECT SURFACE WATER MIGRATION PATHWAWY EXISTS AT THE SITE. SURFACE WATER RUNOFF IS EITHER INFILTRATED INTO THE SOIL OR RECEIVED BY STORM SEWERS. THE STORM SEWERS IN THE STUDY AREA OUTFALL TO THE SITE 2 RECHARGE BASINS. THE NEAREST SURFACE WATER FEATURE IS MASSAPEQUA CREEK LOCATED 3.3 MILES TO THE SOUTHEAST.

Surface Water Pathway Criteria List
Primary Targets

Is any target nearby? (y/n/u)   If yes:
N Drinking water intake
N Fishery
N Sensitive environment

Has any intake, fishery, or recreational area been closed? (y/n/u)

Does analytical or circumstantial evidence suggest surface water contamination at or downstream of a target? (y/n/u)

Does any target warrant sampling? (y/n/u)   If yes:
N Drinking water intake
N Fishery
N Sensitive environment

Other criteria? (y/n)   N

PRIMARY INTAKE(S) IDENTIFIED? (y/n)

ımmarize the rationale for Primary Intakes:

NO SURFACE WATER INTAKES EXIST DOWNSTREAM OF THE SITE. NO DIRECT SURFACE WATER MIGRATION PATHWAY EXISTS FROM THE SITE. SURFACE WATER UNOFF IS EITHER INFILTRATED INTO THE SOIL OR IS RECEIVED BY STORM SEWERS. THE STORM SEWERS IN THE AREA OF THE SITES OUTFALL TO THE SITE 2 RECHARGE BASINS. THE NEAREST SURFACE WATER FEATURE IS MASSAPEQUA CREEK LOCATED 3.3 MILES TO THE SOUTHEAST.

continued -------

continued -------

Other criteria? (y/n) N

PRIMARY FISHERY(IES) IDENTIFIED? (y/n)

Summarize the rationale for Primary Fisheries:

NO PRIMARY FISHERIES EXIST THAT RECEIVE DRAINAGE FROM THE SITE. NO DIRECT SURFACE WATER MIGRATION PATHWAY EXISTS FROM THE SITE.

Other criteria? (y/n) N

PRIMARY SENSITIVE ENVIRONMENT(S) IDENTIFIED? (y/n)

Summarize the rationale for Primary Sensitive Environments:

NO PRIMARY SENSITIVE ENVIRONMENTS EXIST THAT RECEIVE DRAINAGE FROM THE SITE. NO DIRECT SURFACE WATER MIGRATION PATHWAY EXISTS FROM THE SITE.

SURFACE WATER PATHWAY SCORESHEETS

Pathway Characteristics		Ref
Do you suspect a release? (y/n)	No	
Distance to surface water (feet):	17424	9,1
Flood frequency (years):	>500	10
What is the downstream distance (miles) to:		
a. the nearest drinking water intake?	0.0	6,7
b. the nearest fishery?	3.3	10
c. the nearest sensitive environment?	0.0	10

LIKELIHOOD OF RELEASE	Suspected Release	No Suspected Release	Reference
1. SUSPECTED RELEASE	0		
2. NO SUSPECTED RELEASE		100	
LR =	0	100	

20

Drinking Water Threat Targets

TARGETS	Suspected Release	No Suspected Release	Referenc
3. Determine the water body type, flow (if applicable), and number of people served by each drinking water intake.			
4. PRIMARY TARGET POPULATION 0 person(s)	0		
5. SECONDARY TARGET POPULATION Are any intakes part of a blended system? (y/n): N	0	0	
6. NEAREST INTAKE	0	0	
7. RESOURCES	0	5	
T =	0	5	

Drinking Water Threat Target Populations

Intake Name	Primary (y/n)	Water Body Type/Flow	Population Served	Ref.	Val
None					

Total Primary Target Population Value
Total Secondary Target Population Value

21

Apportionment Documentation for a Blended System

NONE

Human Food Chain Threat Targets

TARGETS	Suspected Release	No Suspected Release	Reference
8. Determine the water body type and flow for each fishery within the target limit.			
9. PRIMARY FISHERIES	0		
10. SECONDARY FISHERIES	0	0	
T =	0	0	

Human Food Chain Threat Targets

Fishery Name	Primary (y/n)	Water Body Type/Flow	Ref.	Valu
None				

Total Primary Fisheries Value	0
Total Secondary Fisheries Value	0

Environmental Threat Targets

TARGETS	Suspected Release	No Suspected Release	Reference
11. Determine the water body type and flow (if applicable) for each sensitive environment.			
12. PRIMARY SENSITIVE ENVIRONMENTS	0		
13. SECONDARY SENSITIVE ENVIRONS.	0	0	
T =	0	0	

Environmental Threat Targets

Sensitive Environment Name	Primary (y/n)	Water Body Type/Flow	Ref.	Valu
None				

Total Primary Sensitive Environments Value	0
Total Secondary Sensitive Environments Value	0

Surface Water Pathway Threat Scores

Threat	Likelihood of Release(LR) Score	Targets(T) Score	Pathway Waste Characteristics (WC) Score	Threat Scc LR x T x / 82,50C
Drinking Water	100	5	18	0
Human Food Chain	100	0	18	0
Environmental	100	0	18	0

SURFACE WATER PATHWAY SCORE: | 0

Soil Exposure Pathway Criteria List
Resident Population

Is any residence, school, or daycare facility on or within 200 feet of an area of suspected contamination? (y/n/u)

Is any residence, school, or daycare facility located on adjacent land previously owned or leased by the site owner/operator? (y/n/u)

Is there a migration route that might spread hazardous substances near residences, schools, or daycare facilities? (y/n/u)

Have onsite or adjacent residents or students reported adverse health effects, exclusive of apparent drinking water or air contamination problems? (y/n/u)

Does any neighboring property warrant sampling? (y/n/u)

Other criteria? (y/n) N

RESIDENT POPULATION IDENTIFIED? (y/n)

Summarize the rationale for Resident Population:

A RESIDENTIAL NEIGHBORHOOD IS ADJACENT TO SITES 1 AND 2. ACCESS TO THE SITES IS PREVENTED BY A FENCE. HOMES ARE LOCATED WITHIN 200 FEET OF THE FENCELINE. APPROXIMATELY 33 HOMES WITH A TOTAL POPULATION OF 97 RESIDENTS ARE LOCATED WITHIN 200 FEET OF THE SITES. THE 1990 U.S. CENSUS AVERAGE HOUSEHOLD POPULATION FOR NASSAU COUNTY IS 2.93 RESIDENTS.

SOIL EXPOSURE PATHWAY SCORESHEETS

Pathway Characteristics		Ref
Do any people live on or within 200 ft of areas of suspected contamination? (y/n)	Yes	9,1
Do any people attend school or daycare on or within 200 ft of areas of suspected contamination? (y/n)	Yes	1
Is the facility active? (y/n):	Yes	1

LIKELIHOOD OF EXPOSURE	Suspected Contamination	References
1. SUSPECTED CONTAMINATION LE =	550	

Targets

2. RESIDENT POPULATION 97 resident(s) 0 school/daycare student(s)	970	9,13
3. RESIDENT INDIVIDUAL	50	
4. WORKERS 1 - 100	5	14
5. TERRES. SENSITIVE ENVIRONMENTS	0	
6. RESOURCES	5	
T =	1030	

WASTE CHARACTERISTICS

WC = 18

RESIDENT POPULATION THREAT SCORE: 100

NEARBY POPULATION THREAT SCORE: 2

Population Within 1 Mile: 10,001 - 50,000

SOIL EXPOSURE PATHWAY SCORE: 100

Soil Exposure Pathway Terrestrial Sensitive Environments

Terrestrial Sensitive Environment Name	Reference	Value
None		
Total Terrestrial Sensitive Environments Value		

Air Pathway Criteria List
Suspected Release

Are odors currently reported? (y/n/u)

Has release of a hazardous substance to the air been directly observed? (y/n/u)

Are there reports of adverse health effects (e.g., headaches, nausea, dizziness) potentially resulting from migration of hazardous substances through the air? (y/n/u)

Does analytical/circumstantial evidence suggest release to air? (y/n/u)

Other criteria? (y/n) N

SUSPECTED RELEASE? (y/n)

Summarize the rationale for Suspected Release:

NO RELEASE OF CONTAMINANTS VIA THE AIR MIGRATION ROUTE IS KNOWN TO HAVE OCCURRED AT THE FACILITY.

AIR PATHWAY SCORESHEETS

Pathway Characteristics		Ref.
Do you suspect a release? (y/n)	No	
Distance to the nearest individual (feet):	75	9

LIKELIHOOD OF RELEASE	Suspected Release	No Suspected Release	References
1. SUSPECTED RELEASE	0		
2. NO SUSPECTED RELEASE		500	
LR =	0	500	

Targets

TARGETS	Suspected Release	No Suspected Release	References
3. PRIMARY TARGET POPULATION 0 person(s)	0		
4. SECONDARY TARGET POPULATION	0	93	
5. NEAREST INDIVIDUAL	0	20	
6. PRIMARY SENSITIVE ENVIRONS.	0		
7. SECONDARY SENSITIVE ENVIRONS.	0	0	
8. RESOURCES	0	5	
T =	0	118	

WASTE CHARACTERISTICS

	Suspected Release	No Suspected Release
WC =	0	18

AIR PATHWAY SCORE: 13

Air Pathway Secondary Target Populations

Distance Categories	Population	References	Value
Onsite	78	14	[illegible]
Greater than 0 to 1/4 mile	602	9,12	1[illegible]
Greater than 1/4 to 1/2 mile	901	9,12	[illegible]
Greater than 1/2 to 1 mile	11020	9,12	26
Greater than 1 to 2 miles	62034	9,12	27
Greater than 2 to 3 miles	73605	9,12	12
Greater than 3 to 4 miles	88015	9,12	7
		Total Secondary Population Value	93

Air Pathway Primary Sensitive Environments

Sensitive Environment Name	Reference	Value
None		
Total Primary Sensitive Environments Value		

Air Pathway Secondary Sensitive Environments

Sensitive Environment Name	Distance	Reference	Value
None			
Total Secondary Sensitive Environments Value			

SITE SCORE CALCULATION	SCORE
GROUND WATER PATHWAY SCORE:	100
SURFACE WATER PATHWAY SCORE:	0
SOIL EXPOSURE PATHWAY SCORE:	100
AIR PATHWAY SCORE:	13
SITE SCORE:	71

SUMMARY

---

1. Is there a high possibility of a threat to any nearby drinking water well(s) by migration of a hazardous substance in ground water? **Yes**

   If yes, identify the well(s).
   NUMEROUS PUBLIC WATER SUPPLY WELLS EXIST IN THE AREAS SURROUNDING THE SITE. 16929 RESIDENTS RELY ON GROUNDWATER OBTAINED WITHIN 1 MILE OF THE SITE.

   If yes, how many people are served by the threatened well(s)? **16929**

2. Is there a high possibility of a threat to any of the following by hazardous substance migration in surface water?
   A. Drinking water intake **No**
   B. Fishery **No**
   C. Sensitive environment (wetland, critical habitat, others) **No**

   If yes, identity the target(s).

3. Is there a high possibility of an area of surficial contamination within 200 feet of any residence, school, or daycare facility? **Yes**

   If yes, identify the properties and estimate the associated population(
   APPROXIMATLEY 97 RESIDENTS RESIDE IN HOMES LOCATED WITHIN 200 FEET OF SITES 1 AND 2. SOIL CONTAM. IS PRESENT AT THE TWO SITES.

4. Are there public health concerns at this site that are not addressed by PA scoring considerations? **No**

   If yes, explain:

SITE INSPECTION REPORT

SITE SUMMARY AND RECOMMENDATION

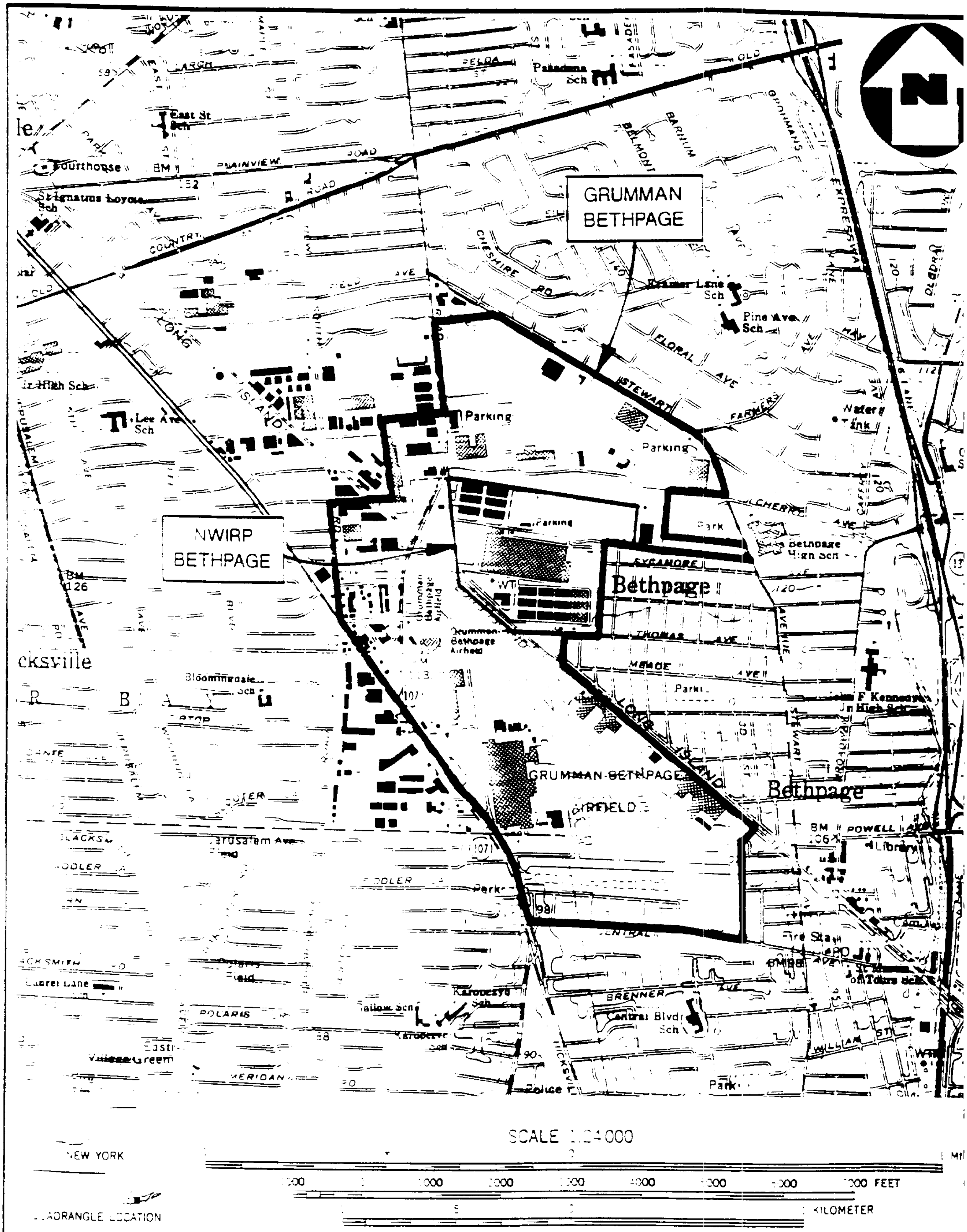
The subject site is approximately 100 acres in area and is owned by the United States Navy. The property is operated by the Grumman Aerospace Corporation and has been used for the development and production of military aircraft since the 1930s. Manufacturing, including extensive metal finishing operations, has taken place on the Navy-owned facility and on adjacent property owned by Grumman throughout the facility's history (see Plate 1).

The area of concern (see figure 1, page 2) evaluated in this scoring package centers on three sites identified in the 1986 NEESA Initial Assessment Study conducted at Bethpage. The area is adjacent to plant no. 3, a large aircraft component manufacturing building, and includes site no. 1, the former drum-marshaling area, site no. 2, recharge basins and sludge-drying beds, and site no. 3, the salvage storage yard (see reference no. 1)

The former drum-marshaling area was used from the 1950s until the early 1980s as a storage yard for drummed wastes. The storage areas were unlined and were not covered. Hazardous materials that were stored in the area include cadmium-bearing liquids, halogenated and nonhalogenated solvents, and cyanide-containing materials. Additionally, the drum-marshaling area was underlain by a septic system leach field that was connected to plant no. 3. Contaminants may have been inadvertently discharged to the leach field in the past.

Site no. 2, the recharge basins, is adjacent to site no. 1. Three basins are present; they are now used to recharge non-contact cooling water, treated process wastewater, and storm water runoff. Before the 1980s, contact cooling water from plant no. 3 was discharged to the basins. A sludge-drying area for the dewatering of wastewater treatment plant sludges is adjacent to the recharge basins. This area was used for the dewatering by infiltration of sludges from the plant no. 2 wastewater treatment plant. These sludges may have contained elevated levels of inorganic compounds, including hexavalent chromium.

Site no. 3, the salvage storage yard, is adjacent to plant no. 3 and the recharge basins. The area has been used since the 1950s for the storage and recycling of fixtures, tools, and metallic wastes. The area has been downsized several times in its history as parking lots have been expanded. Contaminants potentially present include heavy metals, cutting oils, and waste halogenated and nonhalogenated solvents.



SOURCE. (7.5 MINUTE SERIES) U.S.G.S. HICKSVILLE, FREEPORT, HUNTINGTON & AMITYVILLE, N.Y., QUADS.

FIGURE: 1

SITE LOCATION MAP

NWIRP BETHPAGE

(SCALE 1:24000)

HALLIBURTON NU
Environmental Corporation

37

The residents surrounding the site rely on groundwater supplied by municipal authorities for drinking water. Numerous drinking water wells are located within four miles of the site; the closest is located approximately 0.75 mile to the east (see Plate 1).

Private residences are located within 200 feet of site nos. 1 and 2. Access to the areas is limited by a fence and guards.

No surface water migration pathway exists for the site. The majority of runoff either infiltrates the soil or is directed to the recharge basins. The nearest stream is approximately 3.3 miles to the southeast (see Plate 2).

38

SITE ASSESSMENT REPORT: SITE INSPECTION
PART I: SITE INFORMATION

1. Site Name/Alias: Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage
   Street: Stewart Avenue
   City: Bethpage State: New York Zip: 11714

2. County: Nassau County Code: 059 Cong. Dist.: ______

3. EPA ID No.: NY217022162

4. Block No.: ______ Lot No.: ______

5. Latitude: 40° 45' 17" North Longitude: 73° 29' 38" West
   U.S.G.S. Quadrangle: Huntington/Amityville/Hicksville/Freeport

6. Owner: COMNAVAIRSYSCOM Telephone No.: ______
   Street: Naval Systems Air Command Headquarters, Jefferson Plaza 2, Room 528
   City: Washington State: DC Zip: 20361

7. Operator: Grumman Aerospace Corporation Telephone No.: ______
   Street: Stewart Avenue
   City: Bethpage State: New York Zip: 11714

8. Type of Ownership
   - [ ] Private
   - [x] Federal
   - [ ] State
   - [ ] County
   - [ ] Municipal
   - [ ] Unknown
   - [ ] Other ______

9. Owner/Operator Notification on File
   - [ ] RCRA 3001 Date ______
   - [ ] CERCLA 103c Date ______
   - [ ] None
   - [x] Unknown

10. Permit Information

Permit	Permit No.	Date Issued	Expiration Date	Comments
SPDES	NY0096792			cooling water discharge

11. Site Status
    - [x] Active
    - [ ] Inactive
    - [ ] Unknown

12. Years of Operation: 1933 to Present

13. Identify the types of waste sources (e.g., landfill, surface impoundment, piles, stained soil, above- or below-ground tanks or containers, land treatment, etc.) on site. Initiate as many waste unit numbers as needed to identify all waste sources on site.

a. Waste Sources

Waste Unit Number	Waste Source Types	Facility Name for Unit
1	Contaminated Soil	Site 1: Drum-Marshaling Area
2	Contaminated Soil	Site 2: Recharge Basins
3	Contaminated Soil	Site 2: Sludge-Drying Beds
4	Contaminated Soil	Site 3: Salvage Yard

b. Other Areas of Concern

Identify any miscellaneous spills, dumping, etc. on site; describe the materials and identify their locations on site.

None

14. Information available from

Contact Frank Klanchar Agency NAVFACENGCOM Tel. No. (215) 897-6280
Preparer Randy Patarcity Agency HALLIBURTON NUS Date 2/5/92

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site no. 1 - Drum-Marshaling Area

Source Type

____	Landfill	X	Contaminated Soil
____	Surface Impoundment	____	Pile
____	Drums	____	Land Treatment
____	Tanks/Containers	____	Other

Description

The site is an open area that is approximately 400 by 400 feet in size. It was used from the early 1950s until 1978 for the storage of drums containing liquid cadmium waste, cyanide, and waste halogenated and nonhalogenated solvents. The area was unlined and uncovered; up to 300 drums were present at one time. The area was formerly the site of a septic system leach field that served plant no. 3. The plant has been in use since approximately 1940 and has been host to a wide variety of metal-finishing operations, including metal cleaning, painting, and electroplating.

Hazardous Waste Quantity

The quantity of waste stored and/or inadvertently disposed here is not known. The area of the site (400 by 400 feet) will be used.

Hazardous Substances/Physical State

Any wastes stored/spilled/disposed in this area were probably in a liquid form: either liquids in drums or liquids entering the former septic leach field. Potential contaminants include cadmium and other heavy metals and halogenated and nonhalogenated solvents.

Ref. No. 1

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site no. 2 - Recharge Basins

Source Type

	Landfill	X	Contaminated Soil
	Surface Impoundment		Pile
	Drums		Land Treatment
	Tank Containers		Other

Description

Three large recharge basins, each approximately 300 by 300 feet in size, are located on site. The operating maximum fill level is approximately 15 feet. The basins are not normally water filled at all times; generally, only one or two basins receive recharge water at a given time. Before 1984, some plant no. 3 production line rinse waters (contact) were received by the basins. They now receive storm water non-contact cooling water and treated production line rinse waters.

Hazardous Waste Quantity

The hazardous waste quantity is not known. The area of the basins (three times 300 by 300 feet) will be used as the area of contaminated soil for the hazardous waste quantity.

Hazardous Substances/Physical State

Any wastes discharged to the basin were in a liquid form mixed with process/cooling waters. Potential contaminants include chromates (including hexavalent), solvents, corrosives, and heavy metals.

Ref. No. 1

42

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site no. 2 - Sludge-Drying Beds

Source Type

____	Landfill	X	Contaminated Soil
____	Surface Impoundment	____	Pile
____	Drums	____	Land Treatment
____	Tanks/Containers	____	Other

Description

An approximately 300- by 300-foot area adjacent to the recharge basins was used formerly to dewater process wastewater treatment plant sludges generated from plant no. 2. Sludges were piled in this area to allow water to infiltrate into the soil prior to disposal.

Hazardous Waste Quantity

The volume of sludges stored in this area is not known. The approximate area of the drying beds (300 by 300 feet) will be used for the waste quantity.

Hazardous Substances/Physical State

Wastes were deposited in this area as wet sludge. Plant no. 2 processes included metal-finishing activities. Wastewaters from the plant were sent to a wastewater treatment plant on site. The sludges were generated by the treatment plant. Potential contaminants included heavy metals such as hexavalent chromium.

Ref. No. 1

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following items.

Waste Unit Site no. 3 - Salvage Storage Yard

Source Type

____	Landfill	X	Contaminated Soil
____	Surface Impoundment	____	Pile
____	Drums	____	Land Treatment
____	Tanks/Containers	____	Other

Description

The yard is an open area, approximately 300 by 600 feet, used for the storage of scrap metal, fixtures, and tools. A drum storage area for waste oils and halogenated and nonhalogenated solvents formerly existed in the area. The storage yard has been downsized several times since the early 1950s for the expansion of adjacent paved parking areas.

Hazardous Waste Quantity

The quantity of hazardous materials stored/spilled/deposited in the area is not known. The area of the site, 300 by 600 feet, will be used in waste quantity calculations.

Hazardous Substances/Physical State

Liquids such as waste oils and halogenated and nonhalogenated solvents may have spilled from containers or dripped from metal items stored in the salvage yard. Also, it is possible that inorganic contamination, including heavy metals, may be present due to the nature of the materials stored there.

Ref. No. 1

44

PART III: SAMPLING RESULTS EXISTING ANALYTICAL DATA SITE INSPECTION RESULTS

HALLIBURTON NUS Environmental Corporation collected surface and subsurface soil samples in September 1991 and temporary monitoring well samples in August/September 1991. The soils were analyzed for full-scan organic and inorganic parameters, and the groundwater was only analyzed for volatile organic compounds. The following results were obtained:

Site no. 1

- Surface Soils: tetrachloroethane (PCE) (up to 80 ug/kg), trichloroethene (TCE) (up to 17 ug/kg), polychlorinated biphenyls (PCBs) (up to 7,900 ug/kg), DDT (up to 170 ug/kg), DDE (up to 270 ug/kg), cadmium (28.5 mg/kg), chromium (up to 61.1 mg/kg), mercury (5.54 mg/kg), lead (up to 178 mg/kg), and cyanide (5.36 mg/kg)

- Subsurface Soils: PCE (up to 4,800 ug/kg), TCE (up to 78 ug/kg), arsenic (3,380 mg/kg), and cyanide (up to 13.3 mg/kg)

- Temporary Wells: PCE (up to 7,700 ug/l), TCE (up to 1,900 ug/l), 1,1,1-trichloroethane (1,1,1-TCEA) (up to 5,400 ug/l), 1,2-dichloroethene (1,2-DCE) (1,500 ug/l), 1,1-dichloroethane (1,1-DCEA) (up to 620 ug/l).

Site no. 2

- Surface Soils: PCBs (up to 1,900 ug/kg), chromium (up to 419 mg/kg), and lead (up to 49 mg/kg)

- Subsurface Soils: TCE (up to 32 ug/kg), PCBs (up to 6,800 ug/kg), chromium (up to 40.2 mg/kg), and lead (up to 43.4 mg/kg)

- Recharge Basin Sediments: PCE (up to 4 ug/kg) and chromium (up to 18.0 mg/kg)

- Temporary Wells: TCE (up to 9 ug/l)

Site no. 3

- Surface Soils: PCBs (up to 1,360 ug/kg), arsenic (56.8 mg/kg), chromium (up to 637 mg/kg), lead (up to 625 mg/kg), nickel (up to 655 mg/kg), and vanadium (up to 150 mg/kg)

- Subsurface Soils: PCE (55 ug/kg) and lead (up to 19.7 mg/kg)

- Temporary Wells: TCE (up to 76 ug/l), 1,2-DCE (31 ug/l), and PCE (up to 57 ug/l)

Monitoring well sampling of the shallow and intermediate monitoring wells was conducted by HALLIBURTON NUS in December 1991. The data presented below were received on January 9, 1992 and are in the process of being validated. The patterns of contamination are similar to those observed in the September 1991 sampling of the temporary monitoring wells.

Site no. 1

- Shallow Wells: TCE (9 to 1,100 ug/l), PCE (0 to 3,600 ug/l), 1,1,1-TCEA (0 to 10,000 ug/l), and 1,2-DCE (0 to 3,600 ug/l)

- Intermediate Wells: TCE (0 to 13 ug/l)

Site no. 2

- Shallow Wells: Trace TCE and PCE

- Intermediate Wells: Trace TCE and PCE

- Recharge Basins: TCE (7 to 35 ug/l) and 1,1,1-TCEA (up to 6 ug/l)

Site no. 3

- Shallow Wells: TCE (13 to 120 ug/l), 1,2-DCE (100 ug/l), and PCE (75 ug/l)

- Intermediate Wells: TCE (up to 16 ug/l)

- Production Wells: TCE (6 to 110 ug/l) and 1,1,1-TCEA (up to 20 ug/l)

Other Wells

- Well no. HN24I: TCE (58,000 ug/l)

- Well no. HN24S: TCE (61 ug/l), and PCE (14 ug/l)

46

PART IV: HAZARD ASSESSMENT

GROUNDWATER ROUTE

1. Describe the likelihood of a release of contaminant(s) to the groundwater as follows: observed release, suspected release, or none. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release, define the supporting analytical evidence.

   An observed release of VOCs to groundwater has occurred on site.

   Ref. No. 2

2. Describe the aquifer of concern; include information such as depth, thickness, geologic composition, areas of karst terrain, permeability, overlying strata, confining layers, interconnections, discontinuities, depth to water table, groundwater flow direction.

   The site is underlain by Pleistocene outwash sediments ranging from 40 to 130 feet that are known as the Upper Glacial Aquifer. The Upper Glacial Aquifer at the site consists mainly of the Mannetto Gravel, a highly permeable quartz gravel, with mixed silts and clays. The hydraulic conductivity of the formation is approximately 1.7 X 10^{-2} cm/sec. Groundwater can be encountered on site at 40 feet; soil borings conducted by HALLIBURTON NUS revealed a typical depth of approximately 45 feet.

   Underlying the Upper Glacial Aquifer is the Cretaceous Magothy Formation, which is approximately 500 feet thick beneath the site, occurring to a depth of approximately 700 feet. The Magothy is unconfined in the area of the site and contains coarse sand, with scattered clays, lignite, and silts. Hydraulic conductivity in the area of the site is approximately 2.47 X 10^{-2} cm/sec.

   The Magothy is underlain by the clay member of the Raritan Formation, which is approximately 160 feet thick, occurring to a depth of 860 feet. The clay member is of low permeability (9 X 10^{-9} cm/sec). Underlying the clay of the Raritan Formation are sands known as the Lloyd Formation. The Lloyd is approximately 300 feet in thickness in the area of the site; its permeability averages 1 X 10^{-2} cm/sec.

   The Lloyd is underlain by crystalline bedrock in the area of the site, occurring at a depth of approximately 1,200 feet. The bedrock is composed of impermeable schist, gneiss, and granite.

   The flow of groundwater at NWIRP Bethpage is generally to the south. This flow is of a shallow gradient; it mimics surface topography, which slopes very gently to the south.

   Ref. Nos. 1 and 2

3. Is a designated wellhead protection area within four miles of the site?

   No wellhead protection areas have been designated to date.

   Ref. No. 2

4. What is the depth from the lowest point of waste disposal/storage to the highest seasonal level of the saturated zone of the aquifer of concern?

   Depth to groundwater is approximately 20 feet in recharge basin area; basin depth is 25 feet. The depth to groundwater from the surface is approximately 45 feet.

   Ref. Nos. 1 and 2

5. What is the permeability value of the least permeable continuous intervening stratum between the ground surface and the aquifer of concern?

   The sands underlying the site are mixed with discontinuous silts and clays. The hydraulic conductivity is 1.17 X 10^{-2} cm/sec. No confining layers exist (see response no. 2).

   Ref. Nos. 1 and 2

6. What is the net precipitation for the area?

   The gross precipitation for Mineola, New York is 43.65 inches. The mean annual lake evaporation is 30 inches. The net precipitation is 13.65 inches. Mineola is located approximately five miles west of the facility.

   Ref. Nos. 4, 5, and 6

7. What are the distance to and depth of the nearest well that is currently used for drinking purposes?

   The nearest municipal drinking water wells to the site are a cluster of three wells operated by the Bethpage Water District (see Plate 1).

Well Number	Distance	Depth
6078	0.75 mile	275 feet
8767	0.75 mile	640 feet
8768	0.75 mile	678 feet

   Ref. Nos. 6 and 7

8. If a release to groundwater is observed or suspected, determine the number of people that obtain drinking water from wells that are documented or suspected to be located within the contamination boundary of the release.

   None

   Ref. Nos. 2, 6, 7, and 8

48

9. Identify the population served by wells located within four miles of the site that draw from the aquifer of concern.

Distance	Population
0 to 1/4 mile	0
> 1/4 to 1/2 mile	0
> 1/2 to 1 mile	16,929
> 1 to 2 miles	47,174
> 2 to 3 miles	125,413
> 3 to 4 miles	113,244

Ref. Nos. 6, 7, 8, and 9

10. Identify uses of groundwater within four miles of the site (i.e., private drinking source, municipal source, commercial, irrigation, unusable).

Groundwater is extensively utilized as a drinking water source by municipal suppliers.

Ref. Nos. 6, 7, 8, and 9

SURFACE WATER ROUTE

11. Describe the likelihood of a release of contaminant(s) to surface water as follows: observed release, suspected release, or none. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release, define the supporting analytical evidence.

No surface water migration pathway exists at the site. Precipitation reaching the site is either infiltrated into the soil or received by storm sewers. Storm sewers in the study area are discharged to the retention basin (site no. 2). Runoff is not received by any ditch, stream, or other surface water body.

The nearest stream to the site is Massapequa Creek, located 3.3 miles to the southeast. This stream receives no drainage from the site.

As a result of the lack of surface water features, the potential for release by overland flow cannot be evaluated by the HRS scoring model (see Federal Register, December 14, 1990. 40 CFR Part 300, Hazard Ranking System; Final Rule).

Ref. Nos. 1, 9, 10, and 11

12. Identify the nearest downslope surface water. If possible, include a description of possible surface drainage patterns from the site.

The nearest downslope surface water is Massapequa Creek, located 3.3 miles southeast of the site. No direct surface water pathway exists. Precipitation falling on site either infiltrates or is directed via sewers to a drainage recharge basin on site. As per 40 CFR Part 300, Section 4.1.2.1.2.1, no overland component of surface water migration can be evaluated.

Ref. Nos. 9, 10, and 11

13. What is the distance to the nearest downslope surface water? Measure the distance along a course that runoff can be expected to follow.

Massapequa Creek, located 3.3 miles southeast of the site, is the nearest surface water. No direct surface water pathway exists.

Ref. Nos. 10 and 11

14. Determine the flood plain that the site is located within.

The site is located outside the 500-year flood plain.

Ref. Nos. 10 and 11

15. What is the two-year, 24-hour rainfall?

A two-year, 24-hour rainfall event can be expected to reach 3.5 inches. These data were obtained at Mineola, New York, located approximately five miles west of the facility.

Ref. No. 5

16. Identify drinking water intakes in surface waters within 15 miles downstream of the site. For each intake, identify the distance from the point of surface water entry, population served, and stream flow at the intake location.

Intake	Distance	Population Served	Flow (cfs)

None (see comment no. 11).

Ref. Nos. 6, 7, 8, 9, and 10

17. Identify fisheries that exist within 15 miles downstream of the point of surface water entry. For each fishery, specify the following information:

Fishery	Water Body Type	Flow (cfs)

None (see comment no. 11).

Ref. No. 10

18. Identify sensitive environments that exist within 15 miles of the point of surface water entry. For each sensitive environment, specify the following:

Environment	Water Body Type	Flow (cfs)

None (see comment no. 11).

Ref. No. 10

19. If a release to surface water is observed or suspected, identify any intakes, fisheries, and sensitive environments from question nos. 16 through 18 that are or may be located within the contamination boundary of the release.

Intake	Fishery	Environment

None (see comment no. 11).

Ref. Nos. 1 and 10

SOIL EXPOSURE PATHWAY

20. Determine the number of people that occupy residences or attend school or daycare on or within 200 feet of the site property.

97 residents reside within 200 feet of site nos. 1 and 2. This figure was calculated using a house count of 33 homes multiplied by 2.93 (the 1990 United States census average population per household in Nassau County).

Ref. No. 13

21. Determine the number of people that work on or within 200 feet of the site property.

According to NWIRP officials, 78 workers are present daily at the three studied sites.

Ref. No. 14

22. Identify terrestrial sensitive environments on or within 200 feet of the site property.

None (see Plate 2).

Ref. No. 10

AIR ROUTE

23. Describe the likelihood of release of contaminants to air as follows: observed release, suspected release, or none. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release, define the supporting analytical evidence.

None

Ref. Nos. 1 and 2

24. Determine populations that reside within four miles of the site.

Distance	Population
0 to 1/4 mile	602
> 1/4 to 1/2 mile	901
> 1/2 to 1 mile	11,020
> 1 to 2 miles	62,034
> 2 to 3 miles	73,605
> 3 to 4 miles	88,015

Ref. Nos. 9 and 12

25. Identify sensitive environments and wetlands acreage within 1/2 mile of the site.

Sensitive Environment	Distance

None (see Plate 2).

Ref. No. 10

52

26. If a release to air is observed or suspected, determine the number of people that reside or are suspected to reside within the area of air contamination from the release.

    N/A

    Ref. Nos. 9 and 12

27. If a release to air is observed or suspected, identify any sensitive environments, listed in question no. 25, that are or may be located within the area of air contamination from the release.

    N/A

    Ref. No. 10

REFERENCE LIST

1. NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY, INITIAL ASSESSMENT STUDY OF NWIRP BETHPAGE AND NWIRP CALVERTON, NEW YORK. 1986

2. HALLIBURTON NUS ENVIRONMENTAL CORP., DRAFT REMEDIAL INVESTIGATION REPORT FOR NWIRP BETHPAGE. SECTIONS 2 AND 4. FEBRUARY, 1992

3. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, CLIMATOGRAPHY OF THE UNITED STATES NO. 81, MONTHLY NORMALS OF TEMPERATURE, PRECIPITATION, AND HEATING & COOLING DEGREE DAYS, 1951-1980. SEPTEMBER 1982

4. NOAA, CLIMATOGRAPHY OF THE UNITED STATES NO. 20, MINEOLA, NEW YORK CLIMATOLOGICAL SUMMARY. JULY 1984

5. UNITED STATES SOIL CONSERVATION SERVICE, TECHNICAL PAPER NO. 40, RAINFALL FREQUENCY ATLAS OF THE UNITED STATES. UNDATED

6. PUBLIC WATER SUPPLY DATA, NASSAU AND SUFFOLK COUNTIES, NEW YORK. NASSAU COUNTY PLANNING COMMISSION AND SUFFOLK COUNTY PLANNING COMMISSION. SEE PLATE 1

7. NASSAU COUNTY DEPARTMENT OF HEALTH, GROUNDWATER AND PUBLIC WATER SUPPLY FACTS. JUNE 1991

8. NASSAU COUNTY PLANNING COMMISSION, SPECIAL DISTRICTS AND SERVICE AREAS 1980

9. USGS, TOPOGRAPHIC QUADRANGLES. HICKSVILLE, NEW YORK, 1967, FREEPORT, NEW YORK, 1969, HUNTINGTON, NEW YORK, 1967, AND AMITYVILLE, NEW YORK, 1969. SEE PLATE 1

10. US DEPT. OF THE INTERIOR, FISH AND WILDLIFE SERVICE, NATIONAL WETLAND INVENTORY MAPS, HICKSVILLE, NY, APRIL 1981, FREEPORT, NY, APRIL 1981, HUNJTINGTON NY, APRIL 1981, & AMITYVILLE, NY, APRIL 1981 SEE PLATE 2

11. FEDERAL REGISTER, 40 CFR PART 300. HAZARD RANKING SYSTEM - FINAL RULE. DECEMBER 14, 1990

12. US CENSUS, 1990 DATA. TABULATED BY LONG ISLAND PLANNING COMMISSION IN COOPERATION WITH THE NASSAU COUNTY AND SUFFOLK COUNTY PLANNING COMMISSIONS

13. LONG ISLAND LIGHTING CO., 1991 LONG ISLAND POPULATION SURVEY-CURRENT POPULATION ESTIMATES FOR NASSAU AND SUFFOLK COUNTIES. AUGUST 1991

14. HALLIBURTON NUS ENVIRONMENTAL CORP. TELECON, ABE KERN, NWIRP BETHPAGE TO DAVID BRAYACK P.E., HALLIBURTON NUS, FEBRUARY 10, 1992

REFERENCE NO. 1

55

December 1986

INITIAL ASSESSMENT STUDY OF NWIRP BETHPAGE, NY AND NWIRP CALVERTON, NY

NEESA 13-100

NAVAL ENERGY AND ENVIRONMENTAL
SUPPORT ACTIVITY
Port Hueneme, California 93043

RELEASE OF THIS DOCUMENT REQUIRES
PRIOR NOTIFICATION OF THE
CHIEF OFFICIAL OF THE STUDIED ACTIVITY

56

INITIAL ASSESSMENT STUDY

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE AND CALVERTON, NEW YORK

UIC: N96095/N90845

Prepared by:

Rogers, Golden & Halpern
1216 Arch Street
Philadelphia, Pennsylvania 19107

in association with

BCM Eastern Inc.
One Plymouth Meeting Mall
Plymouth Meeting, Pennsylvania 19462

Contract No. N62474-84-C-3386

Initial Assessment Study Team Members

Jack A. Halpern, Principal-in-Charge
Roger D. Moose, Project Manager/Hydrogeologist
Robert W. Pierson, Ph.D., Biochemist and Planner
Paul M. Nikituk, Biologist
Sandy Dechert, Technical Writer
Kevin Murray, Environmental Specialist
Thomas Roginski, Ph.D., Chemical Engineer
Eric Rose, Geologist
Robert H. Zeiders, Geologist

Naval Energy and Environmental Support Activity

Bud Sturtzer, Project Manager

Prepared for:

ENVIRONMENTAL RESTORATION DEPARTMENT
Naval Energy and Environmental Support Activity
Port Hueneme, California 93043

December 1986

57

part, the migration of contaminants entering the Upper Glacial Aquifer water system underlying NWIRP Calverton will conform to the movement of water in the shallow groundwater system; that is, contaminants will migrate south toward Swan Pond, and eventually discharge to the Peconic River system. Additionally, the vertical migration of contaminants into deeper areas of the Upper Glacial Aquifer, and into the underlying Magothy Aquifer, is a probability, if the contaminants are present.

A possible impediment to contaminant migration at the activity is the muck soils that have formed in the swamp areas around Swan Pond. These soils may have significant ion exchange and adsorption capacity that would slow local contaminant migration.

2.2.1.1 Potential Contaminant Receptors. The New York Department of Environmental Conservation (NYDEC) has determined that no Federal or state endangered or threatened species have been reported on Navy property (NYDEC, no date). NYDEC did indicate that significant habitats south of NWIRP Calverton are known to support the tiger salamander (endangered) and the mud turtle (threatened) as well as several species on the state's special concerns list. (The tiger salamander and the mud turtle are listed only on the state endangered species list, not on the Federal List of Threatened and Endangered Species.) The area around Swan Pond is a natural habitat for the mud turtle and the tiger salamander, and therefore these animals are considered potential receptors of contaminants migrating from NWIRP Calverton. Other potential receptors include aquatic life in Swan Pond, the Peconic River, and the Peconic Bay. Humans who consume waterfowl and/or fish from these areas must also be considered potential receptors. Additionally, humans who drink from wells downgradient from the activity must be considered potential contaminant receptors.

At NWIRP Calverton, all potable and process water is supplied by three 12-inch-diameter, 145-foot-deep wells; these are located on-activity, northeast of the Steam Plant (Figure 2-1). Although none of the wells appear to be directly downgradient of any sites identified at the activity, the possibility of contaminants entering these wells from the identified sites exists if pumping from these wells reverses the natural hydraulic gradient. Hence, activity personnel must also be considered potential receptors.

2.2.2 <u>Hydrogeology and Migration Potential at NWIRP Bethpage</u>. NWIRP Bethpage is underlain by Pleistocene outwash sediments (Upper Glacial Aquifer) that range in thickness from 40 to 130 feet. The Magothy Aquifer begins immediately beneath the Upper Glacial Aquifer. The Upper Glacial and Magothy aquifers are the aquifers of concern at this activity; additional information about the geology of NWIRP Bethpage and Long Island in general can be found in Chapter 4.

As a result of extensive urban development, the natural physical features of NWIRP Bethpage are much less varied than those at NWIRP Calverton. There are no surface drainage features, no ponds, and the topography is flat; additionally, soils are almost universally disturbed. According to the Nassau County Department of Public Health, Bureau of Potable Water Supply, there are between 25 and 30 municipal water wells within 1 mile downgradient of the activity (Nassau County Department of Public Health, personal communication, 1986).

The hydrogeology of NWIRP Bethpage is very similar to that of NWIRP Calverton. Hydraulic conductivity in the Upper Glacial Aquifer is about 200 feet per day (Jensen, 1974). Horizontal migration rates, however, are about 50 to 70 feet per day (Jensen, 1974) due to the shallow dip of the land; migration rates at the northwest end of the activity are about 70 feet per day. It is anticipated that rates at the southeast portion of the activity are lower due to lower gradients, as inferred from the low topographic relief in the area. The direction of groundwater migration in the Upper Glacial Aquifer, and in the Magothy Aquifer in the vicinity of NWIRP Bethpage, is south and east toward the Atlantic Ocean.

A member of the Upper Glacial Aquifer, the Mannetto gravel, comprises the surface geology at the activity. This member consists chiefly of a "highly permeable", porous quartz gravel with "excellent infiltration characteristics" (Isbister, 1966). The Mannetto unit is above the groundwater table (Jensen, 1974) and promotes very rapid infiltration.

No natural impediments that would be expected to impede infiltration rates such as soils, clay layers, or tills are in evidence at NWIRP Bethpage. However, extensively paved areas at the activity will reduce migration potential by creating an impermeable barrier to the groundwater system. Nevertheless, the hydrogeology of NWIRP Bethpage is generally very conducive to groundwater migration, and to the migration of water-soluble contaminants.

2.2.2.1 Potential Contaminant Receptors. Because the Upper Glacial and Magothy aquifers are widely used as sources of groundwater on Long Island, and because of the high migration potential of water-soluble contaminants entering the groundwater system, any humans drinking from wells down-gradient from NWIRP Bethpage must be considered potential contaminant receptors.

2.2.2.1.1 Water Sources at NWIRP Bethpage. At NWIRP Bethpage, seven active wells on Navy property supply cooling and process water to the activity. Additionally, there are three deactivated wells on Navy property. The deactivated wells were abandoned due to low delivery rates, screen clogging, and other mechanical problems (NAVPRO, 1986). Figure 2-2 shows the locations of these wells.

2.3 WASTE DISPOSAL AND POTENTIALLY CONTAMINATED SITES.

2.3.1 <u>NWIRP Calverton Sites.</u>

2.3.1.1 Site 1, Northeast Pond Disposal Area. This site is located in the northeastern portion of NWIRP Calverton (Figure 2-3). It lies within the perimeter fence of the activity, at a remote location with respect to

59

Reportedly, the range operated for 1 to 1-1/2 years, until about 1953, when other facilities were built. Presently, no buildings, earthen ramparts, or other structures at the site suggest the range's existence.

In January and May of 1986, the original gunfiring test site was scanned with a metal detector. No ammunition items were detected (Grumman memorandum, July 1986). Therefore, Site 5, NWIRP Calverton 1950s Gun Range Ammunition Disposal Area, is not recommended for a Confirmation Study.

2.3.1.6 Site 6, Fuel Calibration/Engine Run-Up/Fuel Depot Areas. Prior to flight testing, engine and fuel systems are checked at NWIRP Calverton to ensure that these systems are airworthy. Sometimes, when the fuel system of an aircraft is first pressurized, fuel leaks from fittings and tubing.

There are five areas where chronic fuel spillage may have occurred at NWIRP Calverton (Figure 2-8). Three are in the industrialized area: one at the location of the Old Fuel Calibration Pad, southeast of the present aircraft shelters; one at the Engine Run-Up Area; and another at the Engine Test House. The other locations are the Run-Up Area along Runway 32-14 and the taxiway at the southeast end of Runway 32, where aircraft were prepared for their initial flights. All locations are outdoors.

Records indicate that 230 gallons of fuel has spilled at these sites since base operations began. Remedial actions were carried out for each occurrence.

Surface runoff and the shallow groundwater could transport fuel spilled at any of these areas to the area south of the activity, which NYDEC has identified as a habitat for the endangered tiger salamander and the mud turtle.

35

Since records of spills at Engine Run-Up Areas at NWIRP Calverton were not kept until 1981, available records for spills are considered representative of past occurrences. All recorded spills were cleaned up.. However, the proximity of a habitat that supports endangered species, and the likelihood that fuel spilled at the Engine Run-Up and Calibration Areas would enter and contaminate these habitats, require that Site 6, NWIRP Calvedrton Fuel Calibration/Engine Run-Up Areas, be recommended for a Confirmation Study.

2.3.2 NWIRP Bethpage Sites.

2.3.2.1 Site 7, Former Drum Marshaling Areas. Starting in 1969, hazardous waste management practices for Grumman facilities on Long Island included marshaling of drummed wastes on the Navy property at NWIRP Bethpage. Such storage first took place on a cinder-covered surface over the cesspool field east of Plant 03, (Area 2, Figure 2-9). From the early 1950s through about 1978, drums containing liquid cadmium waste were stored here. In 1978, the collection and marshaling point was moved a few yards south of the original unpaved site, to an area on a 100 by 100-foot concrete pad (Area 1, Figure 2-9). This pad had no cover, nor did it have

60

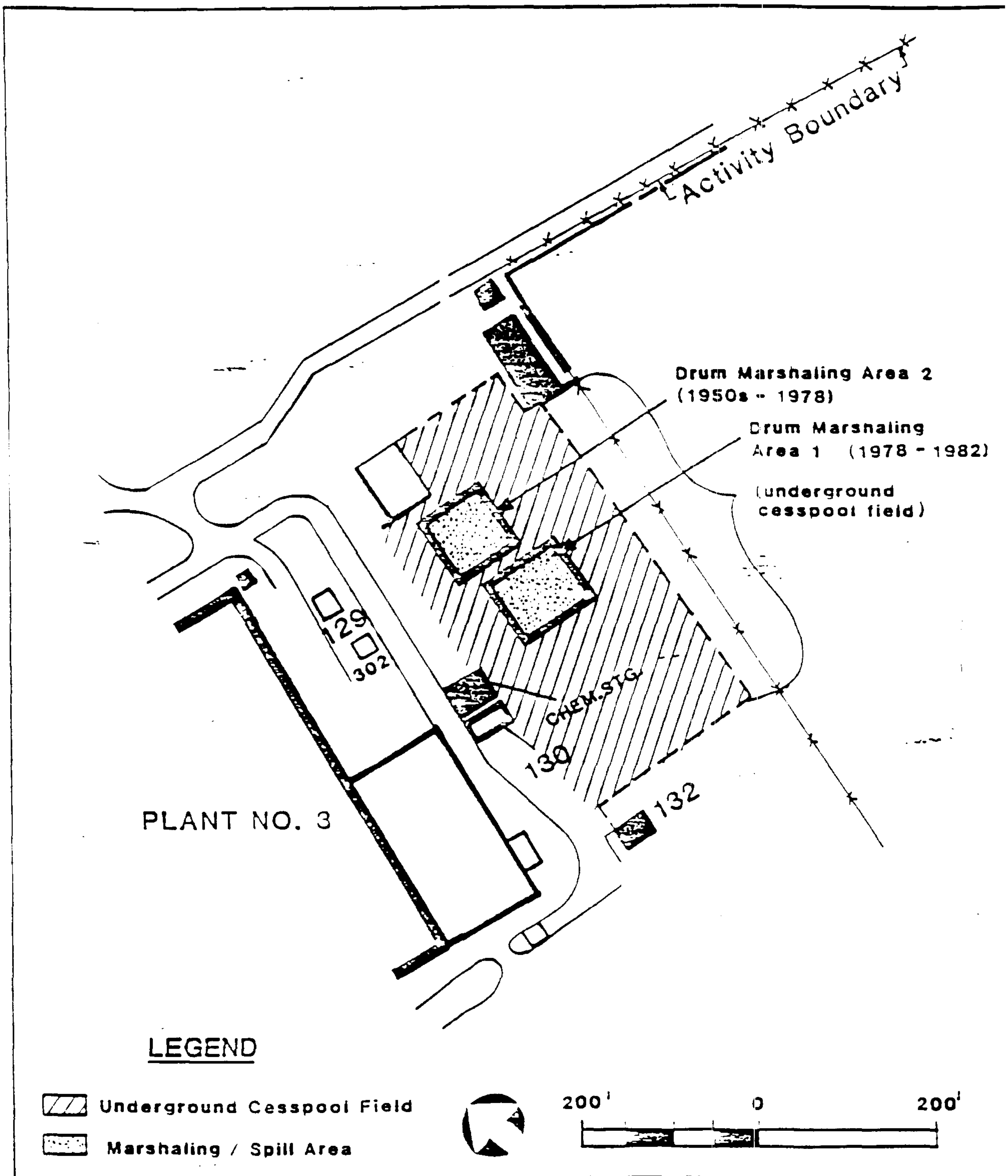


Figure 2-9

Site 7, NWIRP Bethpage Former Drum Marshaling Areas

Initial Assessment Study
Naval Weapons Industrial Reserve Plant
Bethpage and Calverton
Long Island, New York

61

berms for containment of spills. In 1982, drummed waste storage was transferred to the present Drum Marshaling facility, located in the Salvage Storage Area (Site 9); a cover was added in 1983.

Reportedly, all drums of waste marshaled at the Former Drum Marshaling Areas were taken off-activity by a private contractor for treatment or disposal. There are no reports of leaks or spills of drum contents.

Materials stored at the Former Drum Marshaling Areas included waste halogenated and non-halogenated solvents. Cadmium and cyanide were also stored in Area 2 from the early 1950s through 1974. Reportedly, 200 to 300 drums were stored at each area at any one time.

The Mannetto gravel and the Upper Glacial and the Magothy aquifers underlying the site have a high migration potential for contaminants. Additionally, large volumes of hazardous wastes were stored at the site from the early 1950s to 1978, and the site operated without comprehensive containment safeguards.

Reportedly, there is no direct evidence of hazardous waste spills at the site; nevertheless, the IAS team deems it wise to investigate the site, and therefore recommends Site 7, NWIRP Bethpage Former Drum Marshaling Areas, for a Confirmation Study.

2.3.2.2 **Site 8, Recharge Basins.** Surface water drainage on Long Island is for the most part locally controlled, with numerous recharge basins used to channel this resource back to the groundwater. There are several such recharge basins located at NWIRP Bethpage (Figure 2-10).

Prior to 1984, some Plant 03 production line rinse waters were discharged to the recharge basins. The Environmental/Energy Survey of the activity, published in 1976, states that 1.85 million gallons per week were discharged to the recharge beds. These waters were directly exposed to chemicals used in industrail processes (involving the rinsing of manufactured parts). Reportedly, these discharges of dilute rinsewaters did not contain chromates.

Since about 1977, the discharge rate has been 1.4 million gallons per week of non-contact cooling water. All discharge presently goes to the Industrial Wastewater Treatment Plant.

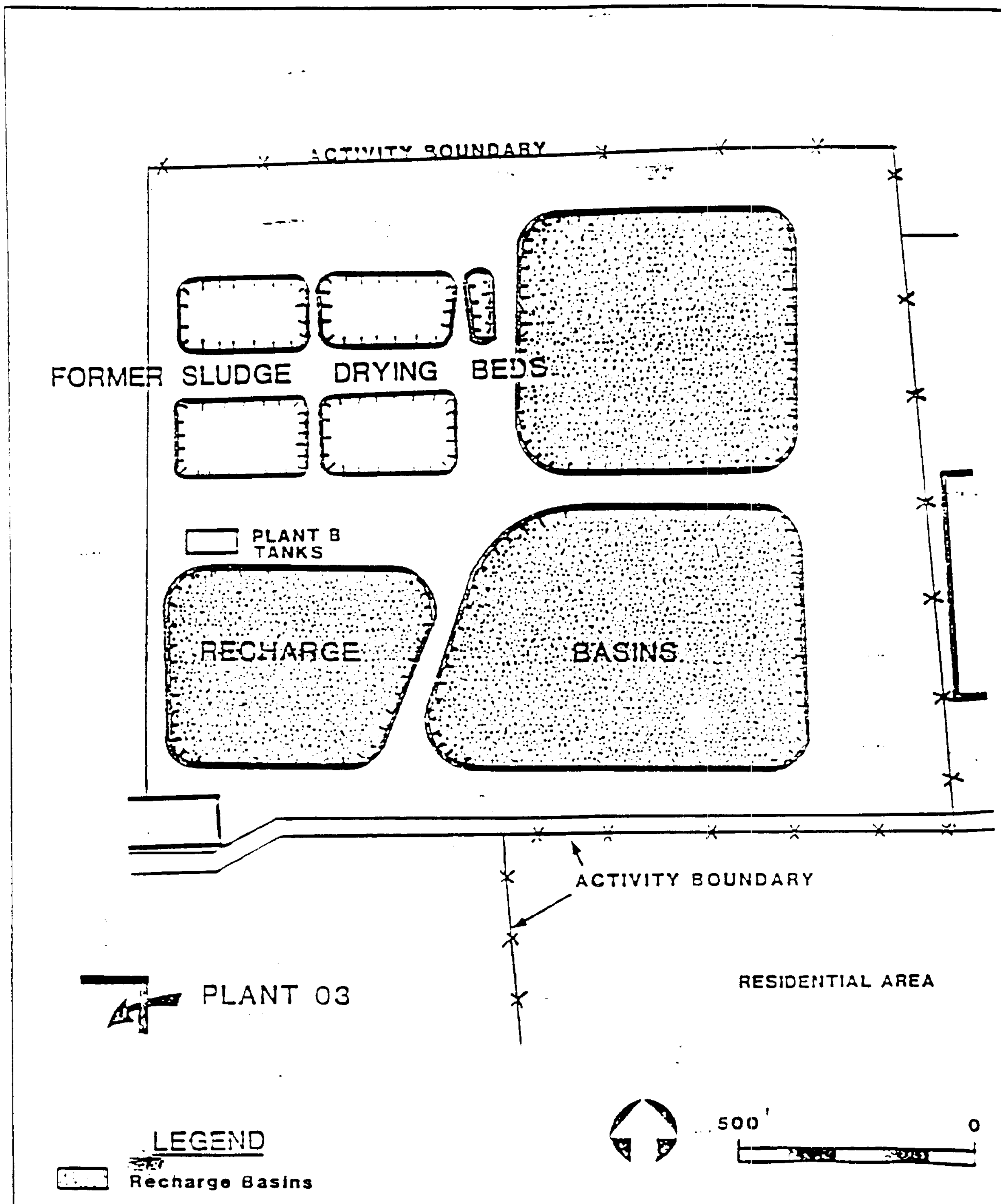


Figure 2-10

Site 8, NWIRP Bethpage Recharge Basins

Initial Assessment Study
Naval Weapons Industrial Reserve Plant
Bethpage and Calverton
Long Island, New York

63

Also, adjacent to the recharge basins are the former sludge drying beds. Sludge from the Plant 02 Industrial Waste Treatment Facility was dewatered in the drying beds before off-site disposal.

On at least one occasion, sampling performed by the Nassau County Department of Health detected levels of hexavalent chromium in excess of allowable limits (see Appendix C). Grumman was notified of this noncompliance and asked to perform remedial actions necessary to eliminate the problem. Reportedly, Grumman complied with the request.

Contaminants of concern include the hexavalent (and other valence) chromium, aluminum, nitric acid, and sulfuric acid.

Because direct evidence of past hazardous waste disposal has been collected regarding the recharge basins, Site 9, NWIRP Bethpage Recharge Basins, is recommended for a Confirmation Study.

2.3.2.3 **Site 9, Salvage Storage Area.** The NWIRP Bethpage Salvage Storage Area is located north of Plant 03 (Figure 2-11). Fixtures, tools, and metallic wastes were stored here prior to recycling from the early 1950's through 1969.

Stored materials included aluminum and titanium scraps and shavings. While in storage, cutting oils dripped from some of this metal. During the 1985 visit, IAS team members observed oil-stained ground at the site. However, soil tests performed by Grumman in 1984 revealed that oil stains were superficial; oil residues were not detected below the top several inches of soil material in the Salvage Storage Area at the locations tested (NAVPRO, 1986).

Around 1960, the Salvage Storage Area was reduced in size to accommodate parking. Around 1970, it was reduced again for the same reason. Consequently, storage facility locations at this site have been periodically moved to accommodate changes in storage area size.

In addition to salvage storage, a 100 by 100-foot area within the boundary of the Salvage Storage area was used for the marshaling of drummed waste. The area was paved with coal ash cinders. Drum marshaling continued here from the early 1950s to 1969. Wastes marshaled throughout the area included waste oils, and waste halogenated and non-halogenated solvents.

Potential contaminants of concern at Site 9 (from both drum marshaling and salvage storage) include cutting oils, aluminum, titanium, and halogenated and non-halogenated solvents. Because of the proximity of aquifers used for potable and process waters, the high migration potential of these aquifers, and the reported storage (without containment safeguards) of hazardous wastes at the site, the IAS team deems it prudent to further investigate the possiblity of hazardous waste contamination at this site, and recommends Site 9, NWIRP Bethpage Salvage Storage Area, for a Confirmation Study.

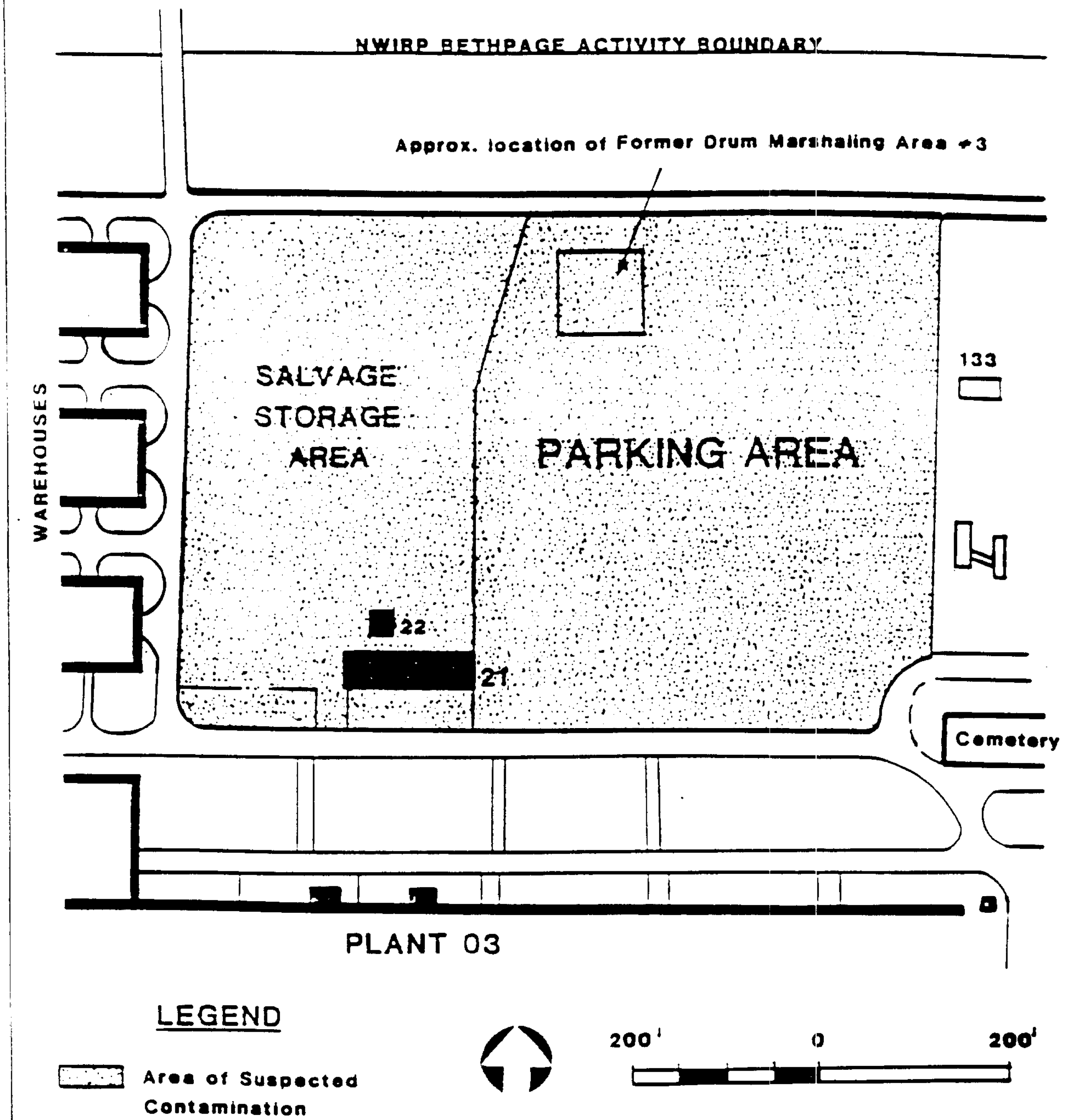
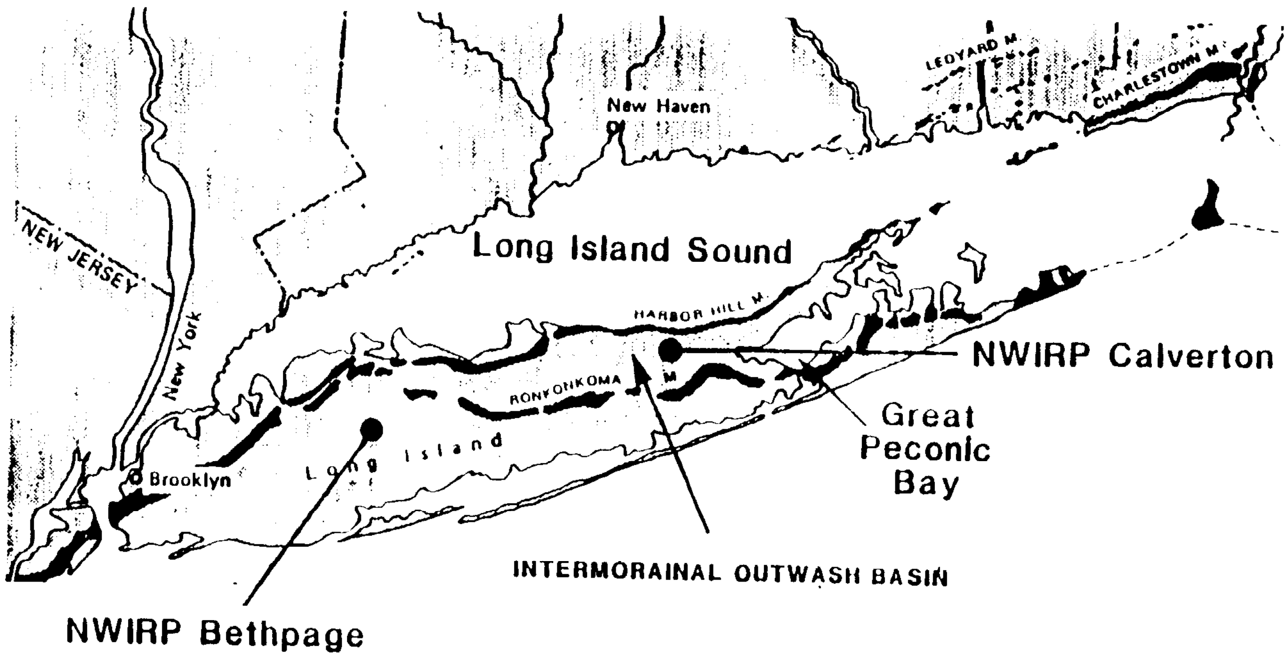


Figure 2-11

Site 9, NWIRP Bethpage Salvage Storage Area

Initial Assessment Study
Naval Weapons Industrial Reserve Plant
Bethpage and Calverton
Long Island, New York

65



Source: after Flint, 1971

0 30 MILES

Figure 4-4

Harbor Hill and

Initial Assessment Study
Naval Weapons Industrial
Reserve Plant

99

CHAPTER 4. BACKGROUND

4.1 NAVAL WEAPONS INDUSTRIAL RESERVE PLANT BETHPAGE, NEW YORK.

4.1.1 General. The Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage is located in Nassau County, New York, near the geographic center of Long Island (Figure 4-1).

NWIRP Bethpage conducts research prototyping, testing, design engineering, fabrication, and primary assembly of various military aircraft. Secondary assembly of components manufactured at NWIRP Bethpage occurs at NWIRP Calverton, located in Suffolk County on Long Island; section 4.2 of this report discusses NWIRP Calverton and its mission in greater detail.

Recent projects at NWIRP Bethpage have included the F-14 (Tomcat), E-2C (Hawkeye), A-6, EA-6B, EF-111A, C-2A, and others. Manufacturing processes performed at NWIRP Bethpage include chemical milling and treating, heat treatment, and mechanical manufacturing processes dealing with aluminum, titanium, honeycombing, plastics, and other components. The plant is government-owned, contractor-operated (GOCO); the company that operates the activity is Grumman Aerospace Corporation.

The facilities at NWIRP Bethpage include four plants (Plants 03, 05 and 20, for assembly and prototype testing, and Plant 10, an integrated group of quality control laboratories), two warehouses (north and south), a Salvage Storage Area, an Industrial Waste Treatment Plant and several artificial recharge basins, and other smaller support buildings (Grumman, no date).

Adjoining the Navy's NWIRP at Bethpage are the corporate headquarters of Grumman Aerospace, the company's principal engineering and manufacturing facilities, Grumman research and development centers, and a major warehousing complex.

In all, Grumman's property covers approximately 605 acres (ManTech, December 1976) extending from Stewart Avenue on the northeast, to Broadway-Hicksville -Massapequa Road on the southwest. The property is bisected by the Long Island Railroad. South Oyster Bay Road and New South Road roughly form the western boundary, and 11th Street and Stewart Avenue mark the eastern boundary (Bethpage Facilities Department, Storm drainage systems, 1979; and Grumman Corporation, Facilities, no date).

Within this Grumman complex lies the 108-acre area owned by the Navy. The major parcel is bordered by South Oyster Bay Road, the Long Island Railroad, Thomas Avenue, 11th Street, the road to the north of Sycamore Avenue, groundwater recharge basins and wooded areas, the hydraulics lab, and the Plant 15 parking area. The other parcel consists of one plant (Plant 20) and its parking area (Bethpage Facilities Department, Storm drainage systems, December 1979; and Grumman Corporation, Facilities, no date).

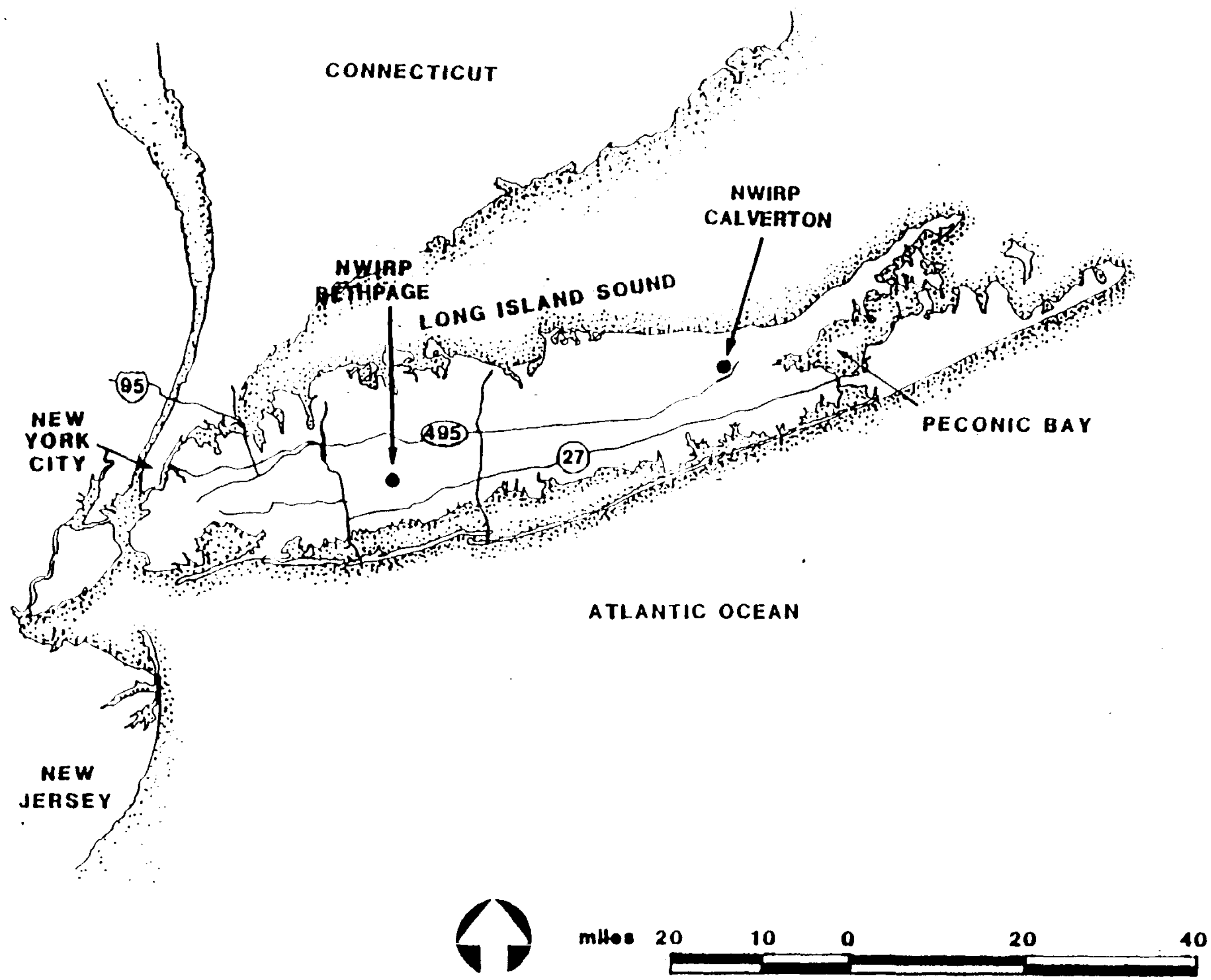


Figure 4-1

General Location Map,
NWIRP Bethpage and
NWIRP Calverton,

Initial Assessment Study
Naval Weapons Industrial
Reserve Plant
Bethpage and Calverton

69

4.1.2 Adjacent Land Uses. Navy-owned land at Bethpage is completely surrounded by the large Grumman complex of research and development centers, manufacturing and assembly plants, test facilities, and corporate headquarters. The industrial complex also has several athletic fields and wooded areas.

When the Navy first came to Bethpage, much of the surrounding land was agricultural; most of it was developed in the late 1950s and early 1960s. At present, suburban housing surrounds most of the Grumman land. Besides the town of Bethpage, these densely populated communities include Levittown, Hicksville, and Plainedge.

Some commercial and light industrial operations flank the railroad to the west of the activity and lie just south of Broadway-Hicksville-Massapequa Road. Route 135, the Seaford-Oyster Bay Expressway, lies one mile east of the activity. Bethpage State Park, with its extensive golf courses, abuts the expressway on the opposite side.

4.1.3 History. NWIRP Bethpage was established in 1933. Throughout the last 50 years, its mission has remained largely the same: to design prototypes, to test Navy aircraft, and to perform primary assembly of various naval aircraft.

From its early days, NWIRP Bethpage was staffed and run mainly by civilian experts and technicians, mostly Grumman personnel. The military oversaw and coordinated these operations.

In the 1930s a series of Navy carrier aircraft and amphibious vehicles were developed at the activity. World War II brought the development of the Wildcat and Hellcat fighters and the Avenger torpedo/bomber/attack plane.

This era also marked a period of very fast growth at NWIRP Bethpage. Most of the currently existing buildings at the activity were constructed for wartime use. This period also marked an employment peak for Grumman; the workforce reached 25,527 in September 1943. Plants 03, 05, 10, 17, and 20 are among those built during the war.

As dramatic as the growth of NWIRP Bethpage was during the war years, so was the slump that followed there after the war. It proved temporary, however, as the jet age and the Korean War once again revived the activity.

For a brief period in the late 1950s, Grumman was not under contract with the Navy to develop and manufacture fighters. However, in 1960 the National Aeronautics and Space Administration (NASA) contracted with NWIRP Bethpage and Grumman to develop the Orbiting Astronomical Observatory (OAO); NASA also contracted for the Echo II satellite and the lunar module that placed Americans on the moon six times.

In 1969, as the first lunar landing took place (from a NWIRP Bethpage lunar module), the activity assumed responsibility for producing the F-14A, the Navy's next-generation fighter plane. The last lunar modules and OAO flight units were delivered in 1971. The first F-14 deliveries, and beginning work on the EA6B, A6E, and E2C aircraft, also began at this time.

69

In the latter half of the 1970s, modifications to Navy planes were made at NWIRP Bethpage. In May 1975, the first of six sets of wing substructures for the space shuttle was delivered to the Navy. Other new aircraft also being worked on included the F-214, the TC-4C, and the EF-111A.

In the early 1980's NWIRP Bethpage broke ground for a major construction project, a $6.3 million Industrial Wastewater Treatment Plant to process chemical effluents from the activity's manufacturing operations. Also at this time, a modern computer and crypto system replaced the activity's antiquated teletype machinery. A new Joint Safety Review Board was created to oversee Bethpage/Calverton operations; production of the new Super Tomcat was also started at this time.

4.1.3.1 Historical Areas. There are no areas of cultural or historic significiance at NWIRP Bethpage.

4.1.4 <u>Legal Actions.</u> On 6 December 1983, a "Letter of Claim" was filed against Grumman Aerospace Corporation by the New York State Department of Environmetnal Conservation. The claim, filed pursuant to section 112(d) of the Comprehensive Environmetal Response, Compensation and Liability Act (CERCLA), is intenced to cover any potential damage to the State's natural resources attributed to Grumman Aerospace's sludge drying beds. The sludge drying beds are located on site 6 adjacent to the ground water recharge basins. Site 6 is recommended for Confirmation Study.

4.1.5 <u>Biological Features.</u>

4.1.5.1 Ecosystems. The Navy property at NWIRP Bethpage is nearly completely developed. Over 90 percent of the facility is covered by buildings, impermeable parking areas, roadways, and other development. Likewise, the land which lies adjacent to Navy property is also urbanized. The biological communities are therefore highly urbanized and no natural habitat exists with the exception of a narrow tree line along part of the northern boundary and scattered, maintained lawn areas around several of the smaller buildings. No natural aquatic habitat exists on the activity.

The urban habitat that is present would only support wildlife species that adjust well in developed surroundings. These species include cottontail rabbit (genus <u>Sylvilagus</u>), squirrel (family Sciuridae), racking (<u>Procyon lotor</u>), field mice (genus <u>Microtus</u>), Norway rat (<u>Rattus norvegicus</u>), and domestic dogs and cats. Similarly, the avifauna include species common in an urban setting. Typical species would include the robin (<u>Turdus migratorius</u>), blue jay (<u>Cyanocitta cristata</u>), starling (<u>Sturnus vulgaris</u>), house sparrow (<u>Passer domesticus</u>), mourning dove (<u>Zenaidura macroura carolinensis</u>), and pigeons (family Columbidae). A small group of Canada geese (<u>Branta canadensis</u>) were observed on some of the larger grassy areas during the site visit during the summer of 1985.

4.1.5.2 Endangered, Threatened, and Rare Species. Endangered and threatened species are animals or plants whose populations have dwindled or whose native habitat has been reduced. The federal government has developed a list of endangered and threatened wildlife and plant species (Federal Register, July 27, 1983) which have been designated by the Department of the Interior to receive protection under the Endangered Species Act of 1973 (Federal Register, 1979).

Through consultations with the New York State Department of Environmental Conservation (NYDEC) Wildlife Resources Center concerning endangered and threatened species at NWIRP Bethpage property, the IAS team has determined that no federal or state endangered and threatened species have been reported at the activity. Likewise, no critical habitat for endangered and threatened species exists at this activity.

4.1.6 Physical Features.

4.1.6.1 NWIRP Bethpage Climatology. The combined influence of prevailing westerly winds and the proximity of the Atlantic Ocean produces a modified continental climate on Long Island. Temperature extremes are mitigated by the Atlantic Ocean and by Long Island Sound. The climate is fairly humid (Isbister, 1966).

Data from Garden City, located 6 miles south and west of NWIRP Bethpage, show that the mean annual precipitation is 45 inches, and there are 20 to 30 thunderstorms each year. Evapotranspiration in Nassau County ranges from 19 to 26 inches, and the mean is about 22 inches. The highest mean temperature is 74.9 degrees F. and occurs in July. The lowest mean temperature is 31.4 degrees and occurs in January (Isbister, 1966).

4.1.6.2 Geology of Long Island. The Bethpage and Calverton activities are located on Long Island, New York. Long Island is roughly 118 miles in length from west to east and averages 20 miles in width from north to south. The island consists of Pleistocene sediments, unconsolidated Pleiocene and Cretaceous sediments, and crystalline metamorphic and igneous Precambrian bedrock (Jensen, 1974; Isbister, 1966; et. al.).

The bedrock is composed of impermeable schist, gneiss, and granite. It is nearly horizontal, although it dips in a southerly direction about one-half of a degree. The bedrock varies in depth from 400 to 2,200 feet below sea level under Long Island (Isbister, 1966; Jensen, 1974 et. al.).

The Cretaceous Raritan Formation overlies the bedrock, and consists of clay and sand members that range in thickness from 100 to 300 feet. The sand member rests directly on the bedrock and is moderately permeable, yielding up to 2,000 gallons per minute (gpm) to individual wells. The clay member of the Raritan Formation rests on the sand member; it is comparatively impermeable and retards, but does not prevent, groundwater movement (Isbister, 1966; Jensen, 1974 et. al.).

The Cretaceous Magothy Formation occurs above the Raritan. The Magothy ranges from 30 to 1,000 feet in thickness. It is moderately to highly permeable, and is the principle source of water on Long Island. Individual wells may yield over 2,000 gpm. The Magothy begins 40 to 350 feet beneath the land surface of Long Island (Jensen, 1974).

Pleistocene sediments on Long Island overlie the Cretaceous units and are all of glacial origin. The glacial deposits are primarily tills comprised of unsorted clays, sand, and boulders (Flint, 1971; Jensen, 1974).

Generally, the glacial deposits have low permeability, leading to perched water tables and slow rates of groundwater migration (Jensen, 1974). The deepest glacial deposit in Nassau County is the James gravel, a glacial outwash deposit that is a significant source of groundwater (Jensen, 1974). Other glacial tills on Long Island may have local unconfined or confined aquifers that provide good quality water for a variety of uses (Jensen, 1974; Isbister, 1966).

Pleistocene epoch glaciation and the concomitant processes of glacial melting and the outwashing of glacially transported materials are largely responsible for the present surface geology and topography of Long Island (Flint, 1971, et. al.).

The Pleistocene epoch is divided into four major glacial stages: the Nebraskan, the Kansan, the Illinoian, and the Wisconsin. Long Island Sound, along with most topographic features on Long Island, was produced by the most recent glacial stage, the Wisconsin (Flint, 1971, et. al.).

There is evidence of two periods of Wisconsin stage advance and retreat on Long Island. During the earlier phase, a glacial ice sheet moved to the middle of Suffolk County and deposited a terminal glacial moraine called the Ronkonkoma Terminal Moraine. The glacier retreated north, then readvanced, this time stopping along Long Island's northern shore; here it deposited the material that forms another series of hilly glacial moraines, the Harbor Hill End Moraine (Flint, 1971, et. al.).

As the ice sheet melted, streams flowing from the glaciers transported large volumes of sand, gravel, and silt to the south. The outwash material was deposited in a flat plain that slopes gently south toward the Atlantic. The outwash plain comprises the flat southern section of Long Island, and an intermorainal area between the Harbor Hill and Ronkonkoma terminal morainal ridges (Flint, 1971).

Recent sediments consisting of salt marsh deposits, stream alluvium, shore deposits, and artificial fill overlie the glacial material. These sediments range in thickness from 0 to 50 feet. Recent clays and silts compose the substrate beneath Long Island Sound and its harbors, retard salt water encroachment into the underlying glacial materials, and confine fresh water in these same materials (Flint, 1971).

4.1.6.2.1 NWIRP Bethpage Geology. NWIRP Bethpage is underlain by Pleistocene glacial outwash material that ranges from 40 to 130 feet in thickness. The Magothy Formation begins immediately beneath the Pleistocene deposits and continues 600 feet to a depth of about 700 feet. The clay member of the Raritan Formation begins at 700 feet and continues to a depth of 860 feet. The Raritan sand member continues to a depth of 1,070 feet. Precambrian bedrock begins at 1,070 feet and continues downward (Jensen, 1974) (Figure 4-2).

4.1.6.3 Topography of NWIRP Bethpage. Northeastern Suffolk County has six major morphologic areas. See Figure 4-2. These are 1) the Headlands, 2) the Harbor Hill End Moraine, 3) an intermorainal pitted

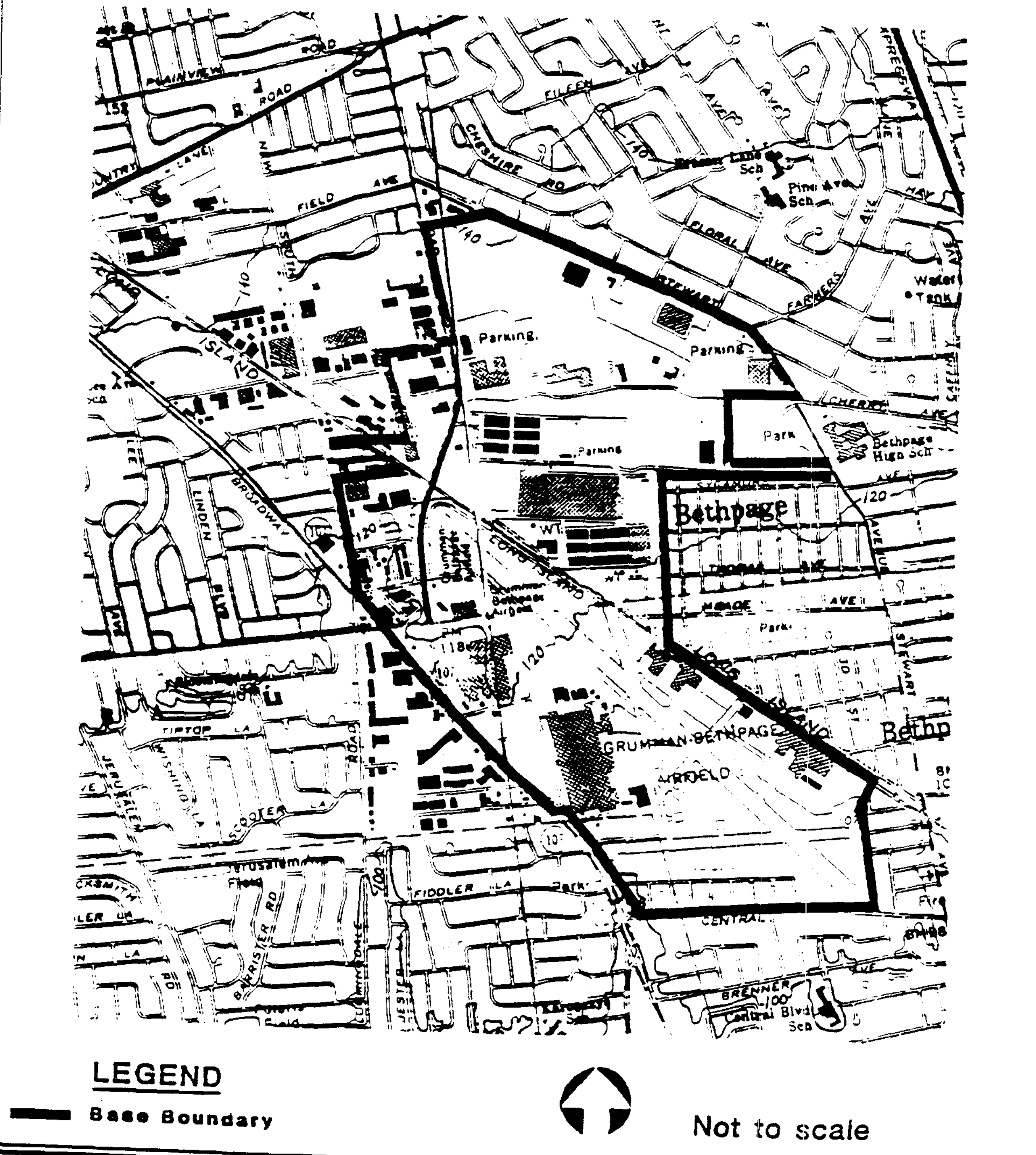


Figure 4-3

Topographic Map,
NWIRP Bethpage, New York

Initial Assessment Study
Naval Weapons Industrial
Reserve Plant
Bethpage and Calverton
Long Island, New York

outwash plain, 4) the Ronkonkoma Terminal Moraine, 5) the Wheatley and Mannetto hills, and 6) the glacial outwash plain (Flint, 1971). The topography of the immediate vicinity of NWIRP Bethpage is shown in Figure 4-3.

The Headlands originate in steep bluffs, which abruptly rise from Long Island Sound to a maximum height of 100 feet. As one proceeds south from the Sound, the land surface becomes increasingly irregular, and it rises to an elevation of about 200 feet near the towns of Jericho and Muttentown.

The Harbor Hill End Moraine consists of hills that trend northeast. These hills reach elevations of 300 feet in the vicinity of Westbury and Wheatley.

The Harbor Hill End Moraine and the Ronkonkoma Terminal Moraine comprise long linear hills that run along the length of Long Island (Figure 4-4). The Harbor Hill End Moraine rises from, and parallels, Long Island Sound. The Ronkonkoma Terminal Moraine runs approximately east-west through the center of Long Island.

Between the two moraines is an intermorainal outwash plain. The plain is pitted with numerous small kames and kettleholes. Its surface is as high as 250 feet above sea level.

A second featureless glacial outwash plain slopes gently from the south edge of the Ronkonkoma Terminal Moraine to the Atlantic Ocean. It ranges from 140 feet above sea level in the north to sea level at the point where it meets the Atlantic Ocean. In the vicinity of NWIRP Bethpage, the elevation is 120 feet.

The Wheatley and Manetto hills rise to about 300 feet above mean sea level in the vicinity of the town of Wheatley, and may be remnants of extensive glacial stream deposits.

In the vicinity of NWIRP Bethpage, all natural physical features such as hills, depressions, and ditches have been reshaped or destroyed because of the high degree of urbanization that the area has experienced. The northwest corner of the activity has the highest elevation, 140-plus feet. The southeast corner of the activity, about 2 miles from the northwest corner, is the lowest part of the activity, with an elevation of under 110 feet. The slope across the activity from northwest to southeast is very regular with no breaks in grade and no topographic features (Figure 4-4).

NWIRP Bethpage is completely surrounded by residential communities, and the effect of the extensive development on groundwater and surface water drainage has been significant. Before widespread development, the naturally occurring, permeable soils allowed rapid infiltration of rainwater. Since this is no longer the case, groundwater recharge is facilitated by recharge basins incorporated into the storm sewer drainage system. The basins allow rainwater to percolate into the ground rather than drain into the local streams (Seaburn and Aronson, 1974). NWIRP Bethpage contains numerous recharge basins, as do the surrounding residential areas.

4.1.6.4 **Soils at NWIRP Bethpage.** The most recent soil information available for NWIRP Bethpage is a soil survey conducted in 1928. According to this report, seven soil types covered the region that is presently overlain by NWIRP Bethpage. The seven are the Sassafras sandy loam, the Hempstead loam, the Plymouth sandy loam, the Haven loam, the Sassafras loam, the Babylon sand, and the Dukes loamy sand. These soils are mostly sand or silty loam, and are characterized by high permeability.

Since the publication of the soil survey report, however, the area of study has been extensively developed and graded. It is unlikely that any of the original soil types remain on the activity. Rather, all the soil under the activity could be better classified as reworked Madeland, or as Cut and Fill material.

4.1.6.5 **Hydrogeology of NWIRP Bethpage.** As mentioned, northeastern Nassau County is underlain by unconsolidated coastal plain deposits of Pleistocene, Cretaceous, and Quaternary age. The deeper lying Cretaceous sediments, the Raritan and Magothy formations, have members that serve as confined aquifers. Moreover, the glacial Quaternary deposits comprise an important aquifer in the county. According to the Nassau County Department of Public Health, Bureau of Public Water Supply, there are approximately 25 to 30 municipal water supply wells within 1 mile downgradient of NWIRP Bethpage. These wells are typically screened in the Magothy Aquifer (Nassau Department of Public Health, 1986).

Groundwater infiltrates the Upper Glacial Aquifer (that is, the glacial Quaternary deposits) in the high morainal hills on the northern side of Long Island. This same area is also the predominant area of recharge for the deeper aquifers. Flow in the Upper Glacial Aquifer, and in the deeper aquifers, is south and east across Long Island toward the Atlantic.

The Lloyd Aquifer, a member of the Cretaceous Raritan Formation, is too deep to be useful as a source of groundwater. The Cretaceous Magothy Formation, however, provides about half of the groundwater used in northeastern Nassau County. This aquifer is predominantly unconfined on Long Island, although locally occurring clay stringers do create confined aquifer conditions. Beneath NWIRP Bethpage, the Magothy is unconfined. Where recharge occurs in the Magothy (north of the activity), head values average 10 feet above sea level. Moving southeast from the recharge area, head values in the Magothy increase, and attain a maximum of 90 feet above sea level in the vicinity of the towns of Jericho and Hicksville. Continuing southeast toward the town of Bethpage, head values decrease; the hydraulic head value at Bethpage is 70 feet above mean sea level (Isbister, 1966). Figure 4-5 illustrates hydraulic head values in the Magothy Aquifer.

The composition of the Magothy Aquifer varies considerably; the aquifer consists of coarse sand with interstitial clay, lignite, stringers of silt and clay, and thin beds of lignite and pyrite. As a result of this varied composition, hydraulic conductivity in the Magothy varies widely. However, it is estimated that the average conductivity in the Magothy is 70 feet per day (2.47 X 10 to the minus 2 cm/s) (Jensen, 1974). In brief summation, then, groundwater in the Magothy in the area of NWIRP Bethpage moves

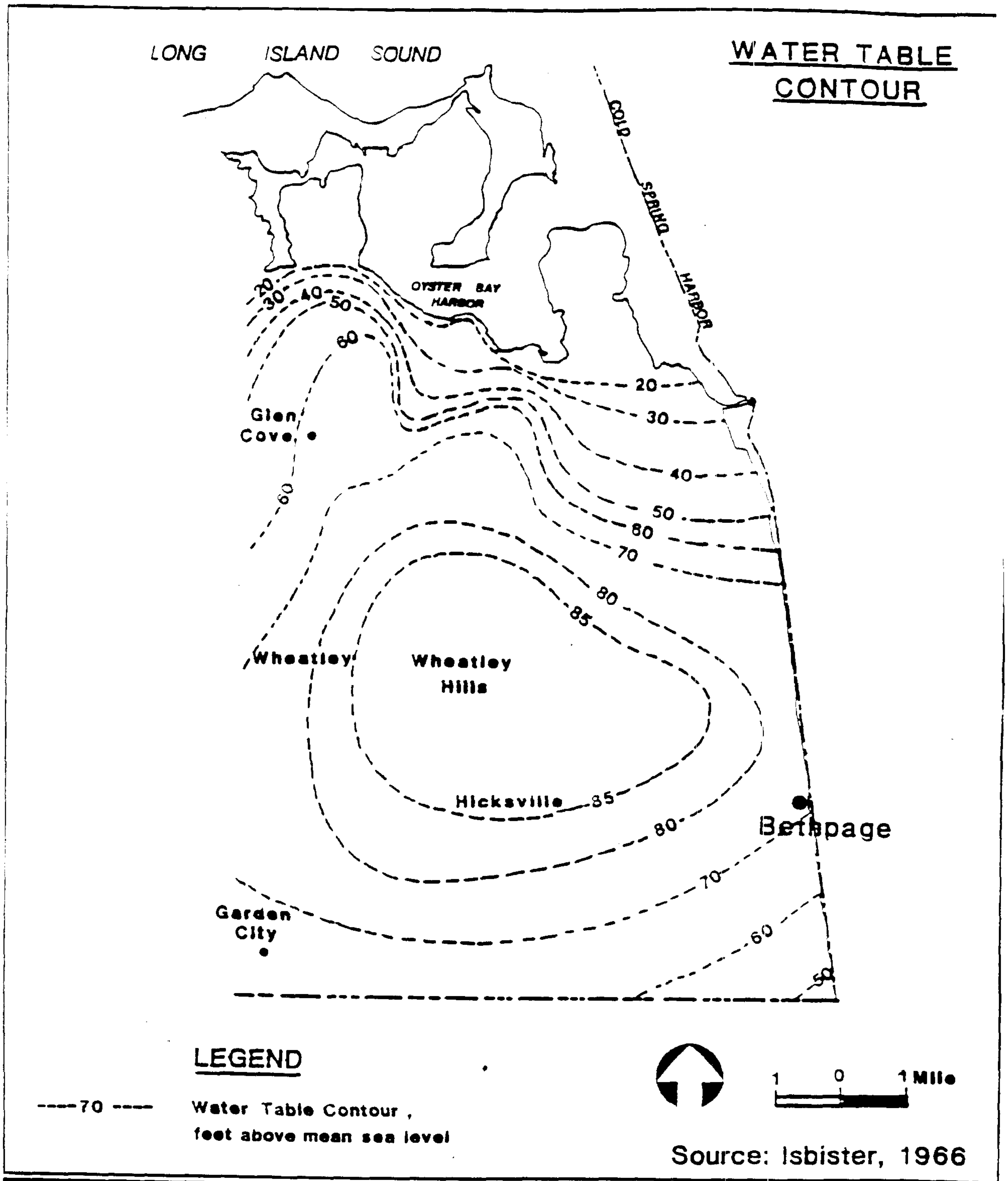


Figure 4-5

Hydraulic Head Values in Magothy Aquifer, Vicinity of NWIRP Bethpage, New York

Initial Assessment Study
Naval Weapons Industrial Reserve Plant
Bethpage and Calverton
Long Island, New York

southeast with an average speed of 70 feet per day, and head values are 70 feet above mean sea level. The Magothy lies about 200 feet below land surface at NWIRP Bethpage, and extends about 700 feet to a depth of 900 feet.

The aquifer of principal interest with regard to NWIRP Bethpage occurs close to the surface in glacial outwash deposits. The outwash deposit aquifer provides some of the groundwater used in Nassau County, and could serve as a pathway for the migration of contaminants as a result of its high permeability.

The region of NWIRP Bethpage is completely underlain by glacial outwash deposits (United States Geological Survey (USGS), 1966). Beneath NWIRP Bethpage, the glacial deposits are about 200 feet thick. Interspersed throughout these deposits are laminar deposits of silt and clay; these deposits impede the downward vertical movement of groundwater and thereby create perched water tables. Water in the outwash deposits exists under water table conditions.

Generally, the outwash deposits beneath NWIRP Bethpage are highly permeable. Porosity is 30 to 40 percent, and permeability in the area ranges from 1,000 gallons per day per square foot (gpd/sq. ft.) to 1,600 gpd/sq. ft. (Jensen, 1974). The average permeability of the outwash deposits is 1,300 gpd/sq. ft. (Jensen, 1974). The hydraulic conductivity of these deposits is high, at 200 feet per day (1.17 X 10 to the minus 2 centimeters per second) (Jensen, 1974). The high porosity of certain areas of outwash material is further demonstrated by the tendency of streams originating in the highlands north of the activity to disappear as they flow south into the flat areas of outwash. Groundwater movement in the outwash deposits is to the southeast in the vicinity of NWIRP Bethpage.

The high porosity of the outwash deposits accounts for the absence of perennial streams in the vicinity of NWIRP Bethpage, and implies that virtually all area water movement occurs through groundwater migration. Close to 100 percent of the water that falls on the area as precipitation infiltrates the ground, and there is practically no runoff, except in periods of very heavy, extended rain. Because the water table in most of Nassau County is below the root zone, evapotranspiration is low, and ranges from 19 to 26 inches in the county, with a mean of 22 inches. Hence, half the 45 inches of precipitation that fall on Nassau County become part of the groundwater system.

Hydraulic gradients beneath NWIRP Bethpage are 10 feet per mile to the south and southeast; in some areas, gradients may increase to 50 feet per mile.

4.1.6.6 Migration Pathways at NWIRP Bethpage. Characteristically, two potential pathways exist for the migration of contaminants. These pathways are through the groundwater and surface waters in an area. In the vicinity of NWIRP Bethpage, however, groundwater alone represents the potential pathway for the migration of contaminants.

As noted in earlier sections of this report, the surface geology in the vicinity of NWIRP Bethpage consists of the highly permeable Manetto gravel. Beneath the gravel lie the Upper Glacial Aquifer and the Magothy Formation. Each of these are highly permeable, and have high hydraulic conductivities (Jensen, 1974). Section 4.1.6.5 lists specific conductivity values for these formations.

Considering the high permeability of the natural surface layers, and the high permeability of the sand and gravel-containing formations immediately underlying the surface layers, there is a very high potential for contaminant migration from the vicinity of NWIRP Bethpage. Contaminants dumped or spilled on the ground surface would infiltrate rapidly, and migrate southeast, the predominant direction of groundwater flow.

4.1.6.7 Potential Receptors. Between NWIRP Bethpage and the Atlantic Ocean, located roughly 6 miles south of the activity, there are no large surface water bodies to which groundwater discharges. Consequently, the potential receptors of contaminants moving through the groundwater system are humans using water from wells located south and east of the activity.

4.2 NAVAL WEAPONS INDUSTRIAL RESERVE PLANT CALVERTON, NEW YORK.

4.2.1 General. The Naval Weapons Industrial Reserve Plant (NWIRP) Calverton is located at the eastern end of Long Island, in Suffolk County, New York (Figure 4-1). NWIRP Calverton covers about 6,000 acres, most of which is in the town of Riverhead. The remaining part of the activity is in Brookhaven.

Like NWIRP Bethpage, NWIRP Calverton is a GOCO activity operated by the Grumman Aerospace Corporation. In total, the facility covers 11 square miles, most of which is owned by the Navy. Plant 08 (an avionics test building) and its guard booth are the only structures situated on land owned by Grumman (General Plan, March 1985).

The mission of NWIRP Calverton is to assemble, develop, and flight-test aircraft for the U.S. military. (NWIRP Bethpage manufactures many of the components assembled and tested at NWIRP Calverton.)

NWIRP Calverton houses 78,000 feet of hangar space, an automated telemetry station, several assembly plants (06, 07, and 08), an anechoic chamber, a test fuel house, a fuel systems lab, a lunar test site, an explosives test facility, a paint shop, a central steam plant, a sewage treatment plant, and other facilities. There are two runways: one is 7,000 feet long, and the other is 10,000 feet long; thus, the activity can accommodate the largest aircraft.

The activity is roughly rectangular in shape. On the north; it is bounded by Route 25 (Middle Country Road). Wading River and Manor Road border the activity to the west, and River Road and Grumman Boulevard border it to the south. A spur of the Long Island Railroad runs inside the central third of the activity's southern perimeter and up into the center of the activity above the main gate. East of the activity is agricultural land.

CHAPTER 5. WASTE GENERATION

5.1 **GENERAL.** The Naval Weapons Industrial Reserve Plants (NWIRPs) at Bethpage and Calverton, New York, generate waste from the production of aircraft, spacecraft, and related components, as well as from functions supporting this production. Grumman Aerospace Corporation operates the plants at both locations. There are four departments, all based at NWIRP Bethpage, that are responsible for servicing the production lines and supporting the operations of both activities. In this section, these departments and their roles will be described to provide background before the discussion of the individual waste-generating shops at NWIRP Bethpage and NWIRP Calverton.

5.1.1 **Manufacturing and Materials Engineering Department.** This department determines which chemical batches should be replenished and which ones should be disposed of. The department does not generate any waste.

5.1.2 **Facilities Engineering Department.** Facilities Engineering is responsible for the evaluation, selection, design and layout of buildings, grounds, utilities, equipment and all other installations required for operation of the facility. They have in-house capability and also use the services of consultants. Facilities Engineering is concerned with contract coordination, security, and safety assurance of private contractors working at the activities. Contractors must submit chemical data sheets for all material used on the job. Waste disposition by the contractor is reviewed by Facilities Engineering for proper disposal by the contractor or by Grumman.

Since 1983, Facilities Engineering has enforced the following rules with respect to construction and maintenance contractor actions that generate construction debris:

- Contractors must use their own dumpsters and take their wastes off-activity;
- Contractors must stockpile fill used on a job at the work site;
- Contractors must take all unus[illegible]rials off-activity after a job is inspected and approved by [illegible]partment.

Contractor requirements prior to 19[illegible] re not available. The Facilities Engineering Department generates only [illegible]aper and assorted office waste.

5.1.3. **Environmental Operations.** This department does the actual work of replenishing chemicals in tanks, or removing contents of tanks and transporting them to the Industrial Wastewater Treatment Plant (IWTP) or to the Drum Marshaling Area (Site 9). The department has had these responsibilities since the early 1950s. Department personnel also operate a spill response truck, which is present at all bulk liquid transfer operations at NWIRP Bethpage; this truck responds to any accidental spills at NWIRP Bethpage, NWIRP Calverton, or Great River, a third Grumman facility on Long

79

Island. Cleanup materials from any spills are taken to the main Drum Marshaling Area (Site 9) at NWIRP Bethpage for off-activity disposal by private contractors. (For a more detailed discussion of the various Drum Marshaling Areas that have been used over the years at NWIRP Bethpage, see sections 6.3 and 6.3.1).

5.1.4 **Facilities Maintenance Department.** The Facilities Maintenance Department is responsible for building, grounds, equipment, and utility maintenance, renovation of office and shop space within existing buildings, and activity security. The department also has prime responsibility for the pickup and storage of waste materials generated by the various shops and assembly lines. The department assigns a superintendent to each of the plants at NWIRP Bethpage and NWIRP Calverton. The Facilities Maintenance Department also has supervisors in charge of various tradesmen and craftsmen who perform maintenance work around the activities. Wastes generated by these groups are discussed in section 5.2.

The Environmental Operations Center is part of the Facilities Maintenance Department. The prime responsibility of the Environmental Operations Center is (in the event of an accident or spill) to secure affected areas as quickly as possible.

5.2 NWIRP BETHPAGE, NAVY PROPERTY.

5.2.1 **Plant 03, Production Lines.** There are several production lines located in Plant 03, at NWIRP Bethpage. All of the production lines located in this plant are used for a variety of aircraft metal treatment and finishing procedures, including chemical surface preparation, electroplating, chemical milling, alodine treatment, and process inspection. The production lines and the specific chemical baths used in each line currently located in this building are listed in Table 5-1. There are two quality control components in the production lines: the Inspection Station and the Zyglo Line. In the latter, aircraft components are submerged in an ultra-violet (UV) visible dye (Zyglo), rinsed, and inspected under UV light for defects into which the dye has penetrated.

A summary of chemical usages for the most recent year for which data was available, and estimates of long-term quantities requiring disposal are listed in Table 5-2. Concentrated waste sodium hydroxide, nitric acid, hydrofluoric acid, chromic acid, and nitric deoxidizer from the production lines are piped to nearby waste concentrate transfer tanks before being transferred to trucks for in-house treatment, or for removal off-activity by a contractor. Dewatered sludges from the IWTP are stored in a rolloff dumpster at the Waste Treatment Plant.

Other concentrated wastes have always been placed in drums for truck transfer to the Drum Marshaling Area (Site 9). Halogenated solvents and non-halogenated solvents are stored in separate containers before pickup. Reportedly, all drums of concentrated wastes have always been removed from the various Drum Marshaling Areas by contractors for reclamation or disposal.

Figure 5-1 is a sketch of Plant 03 showing the locations of the major production lines in the late 1970s. It is noted that the large indoor area

80

Table 5-1

Inventory of 1985 Production Lines
and Associated Chemical Baths
in Plant 03, NWIRP Bethpage,
New York

Production Line	Chemical Baths Used
Chromic Acid Anodize Line*	Alkaline cleaners Alkaline etch Deoxidize (nitric/chromic acids) Chromic acid (Anodize)
Chem Milling Line*	Alkaline cleaners Deoxidize (nitric/chromic acids) Flo-coat (masking) Alkaline etch (aluminum parts) HF Etch (titanium parts) Desmut (nitric acid)
Sulfuric Acid Anodize Line*	Alkaline cleaners Deoxidize (nitric/chromic acids) Sulfuric acid (anodize) Seal Coat
Old Plating Line*	Cd vacuum deposition Nitric acid cleaning bath
Inspection Station*	Sodium hydroxide Acid etch Hydrochloric and nitric acids Chromic acid
Alodine Line*	Alkaline cleaner Deoxidize (nitric/chromic acids) Alodine Conversion Coating
Zyglo Line (quality control)*	Zyglo Dip Tank Emulsion water rinse Developing Tank

* See Table 5-2, Chemical Usage in Plant 03, NWIRP, Bethpage, for additional information.

81

Table 5-2

Chemical Usage in Plant 03,
NWIRP Bethpage

Chemical Used	Annual Quantity	Total Annual Amount Disposed **
Chromic Acid Anodize Line (1981-1985)		
Ridoline-57	1,500 lbs.	6,100 gal.
Aluminetch #3	20,000 lbs.	none*
Amchem-17	4,000 lbs.	
Nitric acid	3,000 gals.	18,400 gal. Nitric acid, Buzz Deox-70, Buzz Deox-170, and Amchem 7 combined.
Buzz Deox-70	3,000 lbs.	
Amchem-7	3,000 lbs.	
Buzz Deox-170	300 lbs.	
Chromic Acid	4,370 lbs.	none
Chem Milling Line (1965-1985)		
Sodium hydroxide	90,000 gals.	388,000 gal. Sodium hydroxide, Sodium sulfide, and Sodium gluconate combined
Sodium sulfide	30,000 lbs.	
Sodium gluconate	8,900 lbs.	
Nitric acid	13,000 gals.	17,300 gal.
Hydrofluoric acid	14,000 gals.	55,200 gals.
Sulfuric Acid Anodize Line (1969-1985)		
Ridoline-57	400 gals	none
Amchem-17	9,000 lbs.	12,000 gal Amchem-17, Amchem-7, Nitric acid, Buzz Deox-70, and Buzz Deox-170 combined.
Nitric acid	5,000 gals.	
Buzz Deox-70	3,000 lbs.	
Amchem-7	3,000 lbs.	
Buzz Deox-170	600 lbs.	
Sulfuric acid	1,300 gals.	7,000 gal.
Sodium dichromate	2,500 lbs.	6,000 gal. Sodium hydroxide and Sodium dichromate combined.
Sodium hydroxide	30 lbs.	
Zygio Inspection Station (1970-1985)		
W8-117	4,000 lbs.	8,000 gal.
Alodine Line (1941-1985)		
Ridoline-57	400 lbs.	none
Sodium sulfate	10 lbs.	none
Alodine 600	300 lbs.	none
Alodine Toner #22	2 gals.	none
Nitric acid	4,000 gals.	5,000 gals. Nitric acid and Amchem-17 combined.
Amchem 17	12,000 lbs.	

(*none = no quantity disposed of; annual quantity used, consumed and/or lost drag out.

** Does not include Drag Out (treated rinse waters.)

Note that Total Amounts are considered to represent total quantities of diluted chemicals, accounting for discrepancy between Annual Quantity used and Total Amount Disposed.

89

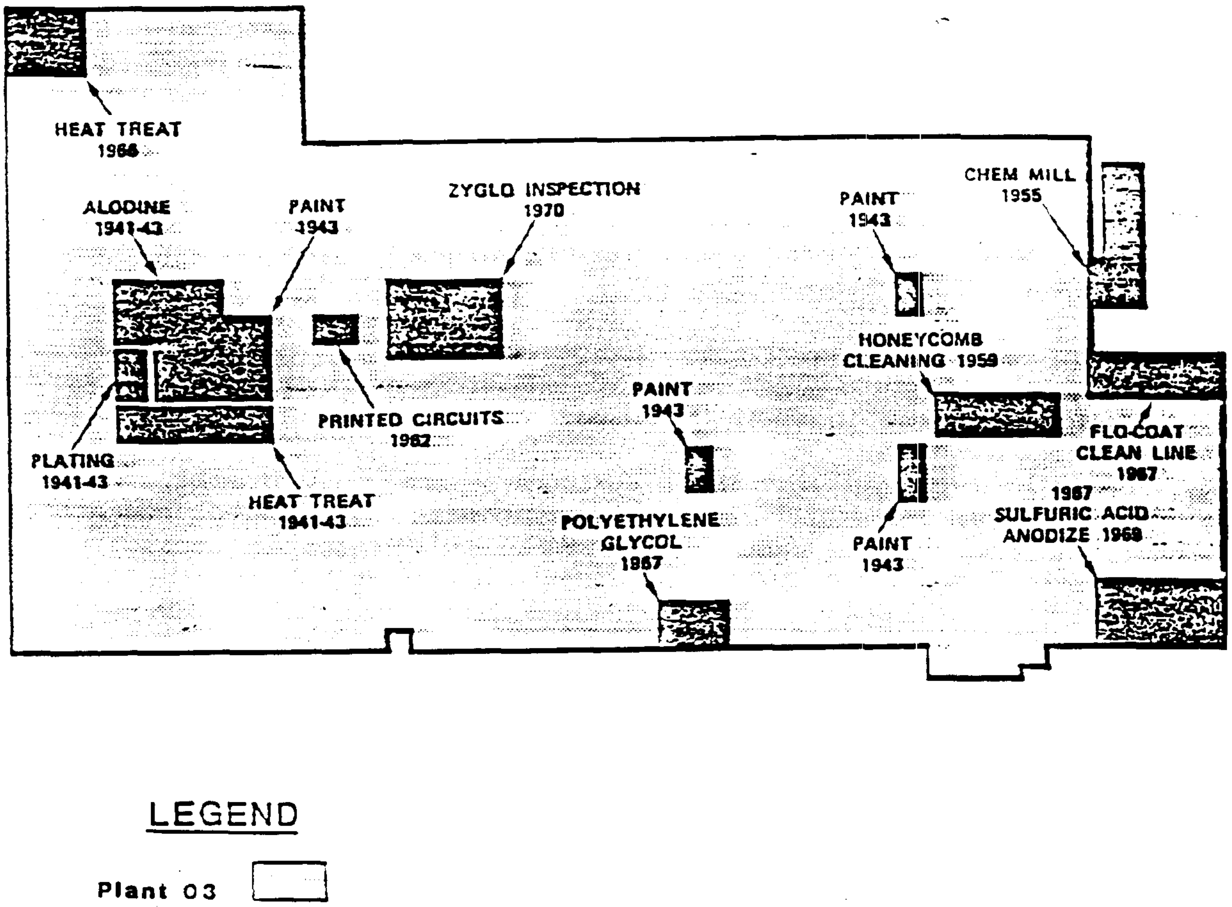


Figure 5-1

Major Production Lines,
Plant 03,
NWIRP Bethpage, New York
Prior to 1980

Initial Assessment Study
Naval Weapons Industrial
Reserve Plant
Bethpage and Calverton
Long Island, New York

83

provided by Plant 03 permitted production lines to be introduced, relocated, and eliminated as production processes and needs changed over the years.

Reportedly, the production processes listed in Tables 5-1 and 5-2 have operated in a fairly constant manner over recent years. Indicated current waste generation rates can be considered a reasonable approximation of average annual chemical usage from the time the production lines began operation until the present. Prior to 1984, dilute rinse waters from these production lines were transported by tank truck to the old Industrial Wastewater Treatment Plant off Navy property in Grumman Plant 02. Since 1984, these rinse waters have been piped direclty to the new Industrial Wastewater Treatment Plant (IWTP) adjacent to Plant 03.

A reclamation system for concentrated chromic acid is located in Plant 03; it serves the Chromic Acid Anodize Process Line. Prior to 1984, rinse waters containing chromates were processed by ion exchange to remove chromates from the recirculating rinse waters. Regeneration wastes from these ion exchanges were treated in the IWTPs.

In addition to the current production lines, the following production lines were located in this building in past years: cadmium plating (1950-1974), honeycomb pretreatment (1960-1983), tank weld cleaning (1950-1970), and chem milling (1956-1980). The latter was relocated in 1980 between the sulfuric acid anodine and Flo-coat Cleanline.

The past usage of chemicals for the honeycomb pretreatment and tank weld cleaning lines is given in Table 5-3. Wastes were pumped to holding tanks for transportation to IWTP for treatment.

Records for the cadmium plating line, which used cyanide salts, are not available. However, cyanide wastes reportedly were treated on the activity and then transported to the Plant 02 IWTP for off-activity disposal.

5.2.2 Plant 10, Quality Assurance Laboratory. The Quality Assurance Laboratory is located in Plant 10, just south of Plant 03. It was constructed and began operation in 1952. The laboratory tests paints and other chemicals used in component production and also evaluates the characteristics of the completed components. The laboratory also performs routine testing of waste streams, and currently employs 35 people.

Solvents used are obtained from the warehouse; other chemicals are ordered by purchase order from the vendor. The quantities of oil, solvent, paint, alkaline, acid, and cyanide wastes currently generated by the lab are listed in Table 5-4. It is estimated that the current waste generation rates have been constant since 1965, but that between 1952 and 1965 the average generation rate was 50 percent of current rates. All wastes except cyanide wastes have always been placed in marked barrels and picked up by the Facilities Maintenance Department for transport to the various Drum Marshaling Areas, where they await off-activity removal. Cyanide wastes are removed directly from the laboratory by Grumman for concentration and subsequent vendor disposal.

Table 5-3

Chemical Usage of Former Production Operations,
Plant 03, NWIRP Bethpage

Chemical Used	Estimated Annual Quantity
Honeycomb Pretreatment (1960-1983)	
Pasa Jell 107M (contains 20% nitric acid, 2.5% chromic acid, and 8% fluorides)	60 gals.
Trichloroethylene	13,000 gals.
Oakite 164	5,000 lbs.
Sulfuric acid	500 gals.
Sodium dichromate	700 lbs.
Sodium hydroxide	150 gals.
Tank Weld Cleaning Line (1950-1970)	
Nitric acid	1,000 gals.
Sodium sulfate	4,000 lbs.
Ridolene 53	400 lbs.

91

85

Table 5-4

Quality Assurance Laboratory Waste Generation,
NWIRP Bethpage, New York *

Chemical	Current Generation Rate Gallons/Year	Gallon Total 1952-1985 (1,000's of Gallons
Oil/water mix	200	6
Methyl ethyl ketone	100	3
1,1,1-trichloroethane	200	6
Paint wastes	100	3
Alkaline wastes (calcium, potassium, sodium, ammonium hydroxides and salts)	300	7
Acid wastes (chromate VI, fluoride, nitrate, sulfate)	1000	30
Cyanide wastes	15	.4

* Total generation rates are calculated assuming current generation rates apply to the period between 1965 and 1985, and that rates between 1952 and 1965 averaged 50 percent of current generation rates. These assumptions ar based on the general level of production at the activity; more specific estimates are not available. All wastes represented in this table were placed in barrels, picked up by Facilities Maintenance, and temporarily stored on-activity prior to off-activity disposal.

86

Waste materials categorized as explosives are stored at the same facilities as new explosives (see section 6.2.3). The explosives are considered waste when their useful date has expired. Over-age explosives remain in the storage area until they are removed and taken to be destroyed. These materials are transported in the NWIRP Calverton explosives vehicle. Waste 1,1,1-trichloroethane and silicone grease are stored in a 55-gallon drum at the firing range. Facilities Maintenance Department personnel are responsible for transporting the drum from the firing range when it is full.

From 1957 to 1985, ammunition-related wastes were disposed of at Site 3, Ammunition Demolition Area. Wastes were destroyed by dumping them into a kettle fire, which caused them to detonate.

6.3 WASTE MATERIALS - NWIRP BETHPAGE. As of June 1985, the Facilities Maintenance Department has been responsible for pickup and storage of barreled wastes from production lines and production support functions. Collection stations for waste halogenated solvents are located at Plants 03 and 10. Waste solvents accumulate at these locations in drums marked for trichloroethylene, methylene chloride, trichloroethane, and freon. Filled drums are moved to the main Drum Marshaling Area. (The main Drum Marshaling Area is located inside a building in the Salvage Sto[illegible]e Area, Site 9, and has been located there since 1982; however, since th[illegible] is a current operation, it is not considered part of Site 9.) Th[illegible] Drum Marshaling Area discussed here has been in operation since 1982; construction on the Drum Marshaling Area was initiated in 1981, it became an active facility in 1982, and in 1983 construction ended when a roof was installed. Prior to 1982, three other Drum Marshaling Areas were used as waste collection points at the activity; these are discussed in greater detail in section 6.3.1.

At present, there are six collection stations for non-halogenated solvents, all of them around Plant 03. Non-halogenated solvent wastes consist mainly of ketones containing paint pigments. They are transported and stored on the activity in the same way as the halogenated solvents, and are sold to solvent reclamation firms for use as fuel. Prior to collection by the vendor, these wastes are stored at the main Drum Marshaling Area. Reportedly, there are no reported leaks or spills of wastes from the main Drum Marshaling Area.

Waste quantities passing through the main Drum Marshaling Area are listed in Table 6-4.

Waste concentrates from various processes are pumped directly from the process tanks to waste concentrate transfer tanks, where they are held for up to 3 days. The wastes are then pumped into trucks for treatment by Grumman for off-activity removal by industrial waste reclaimers. At NWIRP Bethpage, there are six waste concentrate transfer tanks of about 10,000-gallon capacity, and two additional tanks of 5,000-gallon capacity. The tanks are both aboveground and underground. All tanks are dedicated to Plant 03. Individual tanks may contain nitric deoxidizer, chromic acid, sodium hydroxide, nitric, sulfuric, or hydrofluoric acid, and alkaline cleaners and alodine solvents.

87

Table 6-4

Annual Quantities of Wastes Handled by the Main Drum Marshaling Area, NWIRP Bethpage, New York, 1982-1985

Waste Type	Constituents	Waste Quantities Handled (Gallons per Year
Type 1	motor oils*, greases hydraulic oils, mineral oils, kerosene, naptha, gasoline, alcohols, MIL-C-38736 cleaner, Ultrasene PC-63, Penetone TPC, toluene, xylene, Varsol	80,000
Type 2	methylethyl ketone, acetone methyl isobutyl ketone	4,000
Type 3	crystal cut	1,000
Type 4	trichloroethane, methylene chloride, perchloroethylene, trichloroethylene, all freons	20,000
Type 5	brush alodine, chemicals from photo labs, x-ray developers and duplicators	1,000
Type 6	CEE BEE C-50, dirty paint thinners	9,000

*Major constituents

88

6.3.1 **Former Drum Marshaling Areas.** There are three former outdoor Drum Marshaling Areas at NWIRP Bethpage. Areas 1 and 2 are located east of Plant 03, and comprise Site 7; see section 2.3.2.1. The third area, located north of Plant 03 in the Salvage Storage Area, is part of Site 9; see section 2.3.2.3.

Each of the three areas is 100 feet by 100 feet and has a capacity of 200 to 300 barrels. The locations, bottom material on which the barrels rested, and dates of operation of each of the Drum Marshaling Areas are listed in Table 6-5. The IAS team's visual inspection revealed no evidence of leakage at any of the three former Drum Marshalling Areas. However, aerial photographs taken during dates of operation reveal disturbed and stained soils at all three areas.

Waste materials stored at each area included halogenated and non-halogenated solvents, oils, and small quantities of cadmium rinse waters. From the early 1950s to 1974, cadmium wastes containing cyanide were stored at Drum Marshaling Area 2.

6.3.2 **Salvage Storage Area.** The Salvage Storage Area at NWIRP Bethpage has been located just to the north of Plant 03 since the early 1950s. The area is under the supervision of warehouse operations personnel. The Salvage Storage Area, along with Drum Marshaling Area 3, comprises Site 9.

Since 1966, the Salvage Storage Area has been located to the north of the area east of the warehouses; it occupied the entire area east of the warehouses and south to the Salvage Warehouse (Building 21) prior to 1966. The area that is no longer part of the Salvage Storage Area is now paved and is used as a parking lot; paving occurred prior to 1966, and reportedly no cleanup was performed prior to paving.

At the time of the IAS site visit in 1985, the north end of the Salvage Storage Area contained large aircraft components. Retired vehicles and stationary equipment, including small, non-PCB transformers and batteries awaiting sale to off-activity scrap or used equipment dealers, are stored south of this aircraft scrap. There is no evidence that these transformers and batteries were emptied of their contents during storage. During the IAS on-site visit, the area at the north end of the Salvage Storage Area was stained with dark spots of various sizes, indicating numerous oil spills. The spots ranged from 2 to 10 feet in diameter. Reportedly, results of soil sample tests performed by Grumman in 1984 showed that oil stains were superficial.

Areas along the south fence are dedicated to storage of scrap metal. Each month, the activity generates 60,000 pounds of aluminum scrap, 120,000 pounds of light iron, 200,000 pounds of heavy iron, and 25,000 pounds of kirksite (a lead-based material used for dies, shims, and filler). All of this scrap metal is brought to the Salvage Storage Area before being sold to an off-activity contractor. The yard also has a titanium turnings shed, a covered three-sided structure where titanium turnings are stored. The turnings, about 5,300 pounds per month, are also sold to an off-activity contractor. Cutting oil dripping from the turnings drains from the cutting

89

Table 6-5

Active Years of Former Drum Marshaling Areas at NWIRP Bethpage, New York

Area	Location	Base Material	Years Active
1*	east of Plant 03	concrete pad	1978-1982
2*	east of Plant 03	cinder pad	1969-1978
3 **	north edge of Salvage Storage Yard	cinder pad	early 1950s - 1969

* These two former Drum Marshaling Areas comprise Site 7.

** This former Drum Marshaling Area comprises part of Site 9.

baskets and runs across the concrete floor to a grated drain connected to a catch tank. Facilities Maintenance Department personnel periodically empty the catch tank and prepare the oil for off-activity disposal. Reportedly, this has been the case for as long as personnel can remember.

A major change that has occurred in Salvage Storage Area operations since early in the activity's history is the extensive paving of the area east of Building 21. Otherwise, salvage operations have apparently continued with little change.

Mixed scrap metal is brought to the Scrap Sorting Building (a small covered structure located just west of Building 21) for sorting prior to being stored in the Salvage Storage Area. The Scrap Sorting Building served as the construction shack for Plant 03 in 1942 before it was converted to its present use.

6.3.3 <u>**Solid Waste.**</u> Solid waste at NWIRP Bethpage is separated for recycling purposes. The non-recyclable, burnable wastes are hauled off-activity. Non-recyclable, non-burnable wastes are also hauled off-activity. Garbage in barrel or dumpster units is also hauled away by private contractor. Materials sold for recycling include aluminum, iron and steel, titanium, plastic, X-ray film, wire, and computer cards. These practices have continued unchanged since early in the activity's history.

6.3.4 <u>**Waste Oil Storage.**</u> Waste oil at NWIRP Bethpage Plant 03 is stored in two underground tanks. A 2,500-gallon tank installed in 1980 is located in Plant 03 and stores waste cutting oil. The other tank is located at the Industrial Wastewater Treatment Plant, also at Plant 03; it has a 4,000-gallon capacity and was installed in 1982. Transportation Plant 20 has three buried waste tanks (550-gallon capacity) and one 1,000-gallon buried waste tank. The tanks are emptied on an as-required basis by a private contractor.

6.4 WASTE MATERIALS - NWIRP CALVERTON.

6.4.1. <u>**NWIRP Calverton Hazardous Waste Storage.**</u> Since 1975, waste solvents generated at NWIRP Calverton have been placed in containers for shipment to NWIRP Bethpage. Prior to 1975, waste solvents were mixed with waste oil and fuel and placed in waste oil tanks located around the activity. Tanks currently used for the storage of waste oil and fuel are listed in Table 6-6. Apparently, no records regarding the fate of these materials prior to 1975 were maintained, and personnel were unaware of past hazardous waste disposal practices.

About 1,000 to 2,000 gallons per month of oil are used in fire rescue exercises held at Site 2, Fire Rescue Training Area. Fire training exercises have continued since early in the activity's history; present quantities of fuel burned during these exercises are considered representative of quantities used in the past. The remaining volume of waste oil is trucked off the activity by private vendors.

91

Table 6-6
Characteristics and Locations of Waste Oil Storage Tanks
at NWIRP Calverton, New York

Tank No.	Location	Oil Type	Capacity (gallons)	Above or Below Ground	Year Installed
06-1	Rescue training	Waste Oil	1,000	above	1984
06-11-5	E-Fuel Test Lab.	Waste Oil	550	below	1983
06-11-7	G-Fuel Test Lab.	Waste JP5	550	above	1978
06-11-8	H-Fuel Test Lab.	Waste Oil	2,000	below	1980
06-16-7	G-Fuel Calibration	Waste 1010	5,000	below	1980
06-16-8	H-Fuel Calibration	Waste Oil	1,500	above	1980
06-42-1	Transportation	Waste Oil	550	below	1980
06-43-3	C-STP-C	Waste Oil	6,000	above	1984
06-74-1	Machine Shop	Waste Oil	550	below	1983
20-01-7	Fuel Depot	Misc. Oil	550	below	1968
20-01-8	Fuel Depot	Misc. Oil	550	below	1968
20-01-9	Fuel Depot	Misc. Oil	550	below	1968

92

CHAPTER 7. WASTE PROCESSING

7.1 NWIRP BETHPAGE.

7.1.1 <u>Plant 03 Industrial Wastewater Treatment Plant</u>. The Industrial Wastewater Treatment Plant (IWTP) at Plant 03 was completed in 1984. It is designed to treat up to 250,000 gallons per day of waste rinse waters containing metals, hexavalent chromium, and phenols. The facility is also designed to treat concentrates from the metal-finishing baths containing hydrofluoric acid, sulfuric acid, nitric acid, phosphoric acid, high-concentration hexavalent chromium solutions, and alkaline cleaners. Wastewaters are pumped directly to the IWTP from Plant 03; they are also transferred by tank truck from Plant 03. IWTP includes a fluoride and metal precipitation process, a chromate treatment process, and a neutralization process. The treatment process for Plant 03 includes an ion exchange recovery process for concentrated chromic acid. This process produces usable chromic acid from the chromic acid anodize bath at the expense of producing some additional acidic waste.

Sludges produced from waste treatment are conditioned with lime and polymers before vacuum dewatering. The dewatered sludge is collected in a dumpster for removal by an outside contractor.

17 Treated wastewater from Plant 03's IWTP is discharged to the Nassau County sewer system.

Prior to hookup with the new IWTP, Plant 03 sent concentrated industrial waste (17,000 gallons/week) derived from wastewater to a licensed vendor for disposal. Dilute rinse waters (1,850,000 gallons per week) were discharged to groundwater recharge beds. Remaining wastewater (an estimated 100,000 gallons/week), such as zyglo waste, and metal-finishing chemicals were transferred off-activity by Grumman for chromate treatment. These operations continued from the early 1950s to 1984. Only non-contact cooling waters are now discharged to the groundwater recharge basins.

Plant 03's domestic waste is discharged to the Nassau County sewerage system.

7.1.2 <u>Sludge Drying Beds for Plant 02 IWTP</u>. Plant 02 is not on Navy property. However, sludge from the Plant 02 IWTP was dried in Sludge Drying Beds located on Navy property at NWIRP Bethpage prior to 1980.

The sludge from Plant 02 is handled in the same manner as the Plant 03 sludge. It is conditioned, dewatered, and dried. This sludge is subsequently stored at the IWTP in Plant 02 prior to off-activity removal. The Plant 02 IWTP is not located on Navy-owned property. However, the Sludge Drying Beds comprise part of the area of Site 8, and are on Navy property at NWIRP Bethpage.

7.1.3 **Sanitary Wastes.** Sanitary wastes are accepted by Nassau County sewage system interceptors, or are directed to septic systems near certain buildings. Table 7-1 lists which plants are served by these alternatives. Prior to hookup with Nassau County sewage interceptors, Plant 03 and Plant 21 sanitary wastes were treated in septic systems located east of Plant 03, in the area of Site 7. Sanitary wastes from Plants 10, 18, and 20 were also served by septic systems prior to tie-in with the Nassau County sewer system.

7.1.4 **Solid Waste.** All solid wastes at NWIRP Bethpage are separated for recycling purposes. Any non-recyclable, burnable wastes are removed off-activity. Similarly, all non-recyclable, non-burnable wastes are removed off-activity. Garbage disposed of in barrels and dumpsters is also hauled off-activity by a private contractor.

Materials separated and sold for recycling include aluminum, steel,.iron, titanium, plastic, film, and wire.

These current solid waste disposal practices are considered representative of practices dating from the early 1950s. However, the reported recovery of film for recycling did not begin until about 1967.

7.2 NWIRP CALVERTON.

7.2.1 **Industrial Waste Treatment Plant.** The Industrial Waste Treatment Plant (IWTP) went into operation as a prototype facility in 1978, and became fully operative in mid-1979. Prior to this date, all industrial waste water generated at NWIRP Calverton was shipped to NWIRP Bethpage for treatment.

The IWTP provides pretreatment for about 2,000 to 3,000 gpd of industrial wastewaters before release to the sewage treatment plant (STP). The wastes treated at IWTP are generated by the paint shops, paint stripping shop, and the photo lab. The treatment process consists of phenol destruction and chrome reduction, flocuiation with lime and precipitation of the floc with Nalco polymer. Prior to release to the STP, the IWTP effluent is tested for concentrations of cadmium, phenols, chromium (total and hexavalent), silver, cyanide, lead, zinc, fluoride, pH, and total organic carbon.

Before the IWTP went into service, wastes from the paint shops and paint stripping shop were trucked to NWIRP Bethpage. Reportedly, paint sludges have always been trucked to NWIRP Bethpage.

7.2.2 **Waste Oil and Solvent Recovery.** Waste oil and fuels including crankcase oil, hydraulic fluids, and aviation fuels (JP-5 and JP-4) are put into various waste oil storage tanks to await either pickup and off-activity removal by a private contractor or portage to the fire tank at the Fire Rescue Training Area (Site 2).

Table 7-1

Sanitary Sewage Treatment at NWIRP Bethpage, New York

Plant or Building	Date of Tie-in to Nassau STP*	Septic System
Plant 03	1983	-
Building 4	1978	-
Building 5	na.	+
Building 6	1976	-
Building 7	1982	-
Building 8	1980	-
Building 9	1976	-
Plant 10	1975	-
Building 12	na.	+
Building 13	na.	+
Building 14	1975	-
Building 18	ca. 1980	-
Building 19	na.	+
Building 20	1980	-
Plant 20	1976	-
Building 21	1983	-

\+ Indicates that wastes from this Plant or Building are treated at the septic system

\- Indicates that sanitary wastes are not treated in septic systems

na. Indicates that this Plant or Building is not hooked into the Nassau County sewage treatment facilities, and is served by a septic system

*STP - Sewage Treatment Plant

9

About 1,000 to 2,000 gallons of waste oil per year are brought to the fire tank at the Fire Training Area in bowsers and a truck for fire training exercises. The 1,000-gallon fire tank that stores oil for the exercises was constructed in 1984 with a concrete base and bermed perimeter. It replaced a 6,000-gallon tank located near the Fire Rescue Training Area.

Since 1980, waste oil and solvent recovery procedures at NWIRP Calverton have included the following: recycling and off-activity removal by private vendors, incineration at the Fire Rescue Training Area, and removal to NWIRP Bethpage. Prior to 1980, some solvents were mixed with the oil wastes; but these mixtures were also disposed through incinerator at the Fire Rescue Training Area, or off-activity. Since 1980, oils and solvents have been managed separately and taken to NWIRP Bethpage.

7.2.3 **Sewage Treatment Plant.** The Sewage Treatment Plant (STP) at NWIRP Calverton is designed to treat 62,000 gallons per day of domestic sewage, boiler blowdown water, and pretreated industrial wastewater. The STP began operations in 1970; before 1970, wastes were treated by septic systems. The plant treats sewage by extended aeration and activated sludge process with no primary settling. The treated effluent is discharged to McKay Lake, which drains off the activity. About 20,000 gallons per month of sludge from the STP and septic tank cleanout are trucked to a municipal landfill.

The STP serves all plants at NWIRP Calverton except the following: Plant 08; the guard house; the noise check building; the flight emergency building; the Navy shack; the flight shack; the engine run-up area; the training building; the picnic area; gun buts; and the anechoic chamber. These are still served by septic systems or cesspools. The septic tanks and cesspools are pumped and the sludge is trucked to the Riverhead Landfill.

Recent records indicate that three spills have occurred at the Fuel Calibration/Engine Run-Up Areas. On February 24, 1983, about 30 gallons of JP-5 fuel washed onto the ground at the Engine Run-Up Area. On February 9, 1982, roughly 200 gallons of JP-4 fuel spilled at the Engine Test House. On November 28, 1984, an unknown quantity of an oil-water mixture spilled at the Fuel Calibration Area. In each of the above instances, the contaminated soil was removed, and, in the case of the February 1982 spill, an absorbent was also used to contain the spill. Only records of recent spills are available, because prior to 1981 spill records were apparently not kept.

There are five areas (Figure 8-10) at NWIRP Calverton where personnel have performed pre-flight testing and which may be, or may have been, subject to fuel spillage. Three of the areas are in the industrialized section of the activity: one at the Engine Test House, one at the Engine Run-Up Area, and another at the Old Fuel Calibration Pad. The other locations include the discontinued engine run-up apron area along Runway 32-14 and the taxiway at the southeast end of Runway 32, where aircraft were prepared for their initial flights. All of these locations are outdoors.

Aerial photographs taken through 1980 of the Engine Test House and the end-of-runway locations indicate vegetative stress. The stress patterns coincide with aircraft queuing and engine run up areas. There is no conclusive evidence that the vegetative stress was caused by anything but aircraft exhaust.

8.2 NWIRP BETHPAGE SITES

8.2.1 Site 7, Former Drum Marshaling Areas.

Waste management at the Grumman Corporation facilities on Long Island (Bethpage, Calverton, and an electronics plant at Great River) included marshaling wastes at the Navy-owned portion of NWIRP Bethpage for eventual removal off-activity by contractors.

Two former Drum Marshaling Areas are identified in this area, according to an earlier report filed by Grumman with the Solid Waste Branch of the United States Environmental Protection Agency (USEPA) (Ohlmann, 1985). From 1969 to 1978, the drums collected by Grumman from its three facilities were stored on an approximately 100 by 100-foot area of the cinder surface immediately east of Plant 03 (Figure 8-11). In the report mentioned above, this area is referred to as Drum Storage Area No. 2. Storage of 200 to 300 drums at a time is acknowledged. It was also noted that from the early

97

1950s to about 1978, this area was used for storage of drums containing liquid cadmium waste prior to treatment. Cyanide-containing wastes were also stored in drums at the site during these years.

An adjacent area (Figure 8-11) was surfaced with a concrete pad in 1978 (Drum Storage Area No. 1, Ohlmann, 1985). This pad had no berms along its edges and was not covered. Some 200 to 300 drums at a time were stored on this pad. Use of this pad continued until late 1981 or early 1982.

Hazardous waste stored at Drum Marshaling Areas Numbers 1 and 2 included the following: waste halogenated solvents, waste non-halogenated solvents, and liquid cadmium waste. Table 6-4 describes the classes of drummed wastes generated and collected at the Grumman facilities.

8.2.2 Site 8, Recharge Basins. Two recharge basins existed at NWIRP Bethpage by 1953. As indicated by aerial photographs, a third basin located north of these was under construction by 1966. Figure 8-12 shows the site.

The following two paragraphs describe recent (prior to 1984) discharges to the recharge basins. Reportedly, prior to the construction and operation of the Industrial Wastewater Treatment Plant (IWTP) near Plant 03 in January 1984, non-chromated rinse waters from industrial processes were dishcarged to the recharge basins. These waters were contact rinse waters; that is, they came in direct contact with the chemicals used in the industrial processes during rinsing of the fabricated parts. Chemicals potentially present in the rinse waters include aluminum, nitric acid, phosphoric acid, and sulfuric acid. Rinse waters were reportedly discharged in accordance with a state discharge permit.

Some of the Plant 03 production lines which were discharged into the recharge basins on Navy property included: heat treatment quench waters, sulfuric acid anodize rinse waters, alkaline cleaner (phosphate silicate); rinse waters, and Desmut (nitric acid) rinse waters. Prior to 1974, when these rinse waters were dishcarged to the basins, the rinse water flows were perhaps five to seven times the present rate of 1.4 million gallons per week, resulting in significantly higher dilution rates. Reportedly, chemicals potentially present in the rinse waters include aluminum, nitric acid, phosphoric acid and sulfuric acid. Reportedly, no process tanks were ever discharged directly to the recharge basins.

78

Prior to 1980 sludge from plant 02 and plant 03 was dried in sludge drying beds located adjacent to the groundwater recharge basins. Sludge from plant 02 is similar to the sludge from plant 03. Before being placed in the drying beds, the sludge from plant 02 and 03 were conditioned and dewatered. In 1980 the sludge drying beds were reportedly cleaned out.

At times in the past, chromium and cadmium waste streams entered the recharge basins, causing the Nassau County Department of Health to remark about concentrations in excess of allowable limits for hexavalent chromium (McCabe, 1956; see also Appendix C).

Since the completion of the Industrial Wasteswater Treatment Plant near Plant 03, all treatment effluents from Plant 03 have been discharged off-activity to the Nassau County wastewater treatment system. Since 1985, the only discharges from NWIRP Bethpage to the recharge basins are non-contact cooling water and runoff from paved parking lots and roadways. (Non-contact cooling water does not come in contact with chemicals used in industrial processes.)

8.2.3 Site 9, Salvage Storage Area. Since the early 1950's, personnel have stored aluminum and titanium metal scrap and shavings at the Salvage Storage Area prior to off-activity recycling. The scrap metals, along with cutting oil from the sumps from which the metals are collected, are carried to the area in porous-bottom containers by forklift. While the scrap metals are in storage, the oil may drip from the metal or be washed off by rainfall. Presently, a provision exists to collect the oil from the titanium cuttings. Cutting oil dripping from the turnings drains from the cutting baskets and runs across the concrete floor of the shed to a grated drain connected to a catch tank maintained by the Facilities Maintenance Deparmtent. Results of Grumman soil sample tests performed in 1984 reportedly showed no oil contamination at the site (NAVPRO, 1986). During the IAS on-site visit in 1985, small areas of oil drippings were observed. These were apparently also of a superficial nature and did not indicate site contamination.

Between 1953 and 1966, the Salvage Storage Area was reduced in area to accommodate parking. But between 1966 and 1974, additional storage area, north of the Salvage Storage Area and adjacent to the parking lot, was incorporated into the Salvage Storage Area.

In addition to the Salvage Storage Area, a Drum Marshaling Area (Drum Marshaling Area Number 3) existed in this area (see Figure 8-13). The area was approximately 100 by 100 feet in size, and its surface was covered with coal ash (cinders). Approximately 200 to 300 drums were stored in this area at one time. The area operated form the early 1950s through 1969.

Waste stored at Drum Marshaling Area Number 3 include paint waste halogenated solvents, and waste non-halogenated solvents.

Thus, the storage of wastes and recyclable materials at the Salvage Storage Area and at the Drum Marshaling Area Number 3 causes strong reason to believe that the following contaminants occur at Site 9: halogenated and non-halogenated solvents, oil, aluminum and titanium.

99

REFERENCES

Freeze, RA; and Cherry, JA. Groundwater. Englewood, New Jersey: Prentice Hall, Inc., 1979.

Flint, Richard Foster. Glacial and Quaternary Geology. New York: John Wiley and Sons, Inc., 1971.

Jensen, H.M.; Soren, Julian. Hydrogeology of Suffolk County, Long Island, New York. Washington, D. C.: USGS, 1974.

Isbister, John. Geology and Hydrogeology of Northeastern Nassau County, Long Island, New York. Washington, D.C.: USGS, 1966.

Pluhowski, E. Hydrologic Interpretation Based on Infrared Imagery of Long Island, New York. Washington, D.C.: USGS, 1972.

United States Department of Agriculture. Soil Survey of Suffolk County, Long Island, New York. Washington, D.C.: USDA, 1975.

de Laguna, Wallace. Geology of Brookhaven National Laboratory and Vicinity, Suffolk County, New York. Washington, D.C.: USGS, 1963.

de Laguna, Wallace; and Lusczynski, N. Hydrology of Brookhaven National Laboratory and Vicinity, Suffolk County, New York. Washington, D.C., 1968.

Fuller, M.L. The Geology of Long Island, New York. USGS: 1914.

Aerial Photographs of the Vicinity of NWIRP Bethage. USDA: 1953, 1959, 1966, 1974.

Aerial Photographs of the Vicinity of NWIRP Calverton. USDA, 1947, 1957, 1961, 1963, 1966, 1967, 1969, 1971, 1974, 1980.

Guthrie, Charles A. Personal Communication regarding fish population in McKay Pond. New York State Department of Environmental Conservation: Stony Brook, December, 1983.

Brown, Lawrence P. Personal Communication regarding Endangered species present at NWIRP Calverton. New York State Department of Environmental Conservation, Wildlife Resources Center, Delmar, New York: August, 1985.

BIBLIOGRAPHY

Grumman Aerospace Corporation. Grumman Aerospace Spectrum: Facilities and Capabilities. Bethpage, New York: Grumman Aerospace Corporation, no date.

Pye, Veronica; Patrick, Ruth; and Quarles, John. Groundwater Contamination in the United States. Philadelphia: University of Pennsylvania Press, 1983.

New York State/Department of Environmental Conservation. New York State Air Quality Report: Continuous and Manual Air Quality Monitoring Systems. Albany, 1983.

Seaburn, G.E. Preliminary Results of Hydrologic Studies at two Recharge Basins on Long Island, New York. USGS, 1970.

McClymonds, N.E. and Franke, O.L. Water-Transmitting Properties of Aquifers on Long Island, New York. USGS, 1972.

Grumman Aerospace Corporation. Memorandum: Request to Quality Control Laboratory, Monitor Well Test Results. Grumman Aerospace Corporation: Bethpage, March 13, 1985.

147 Grumman Aerospace Corporation. Memorandum: Request to Quality Control Laboratory, Surface Water Test Results. Grumman Aerospace Corporation, Bethpage: August, 1985.

Grumman Aerospace Corporation. Memorandum: Subject: Search for Discarded 20 mm. Ammunition: Bethpage, May, 1986.

Facilities Department, Grumman Aerospace Corporation. Grumman Corporation Facilities. Bethpage, no date.

Grumman Aerospace Corporation. Plant No. 03 - Chemical Tank Addition Survey, Amounts of Partial or Full Dumps. Grumman, Bethpage: January, 1986.

Ohlmann, J. Personal Communication a[illegible]sed to Roger Moose. Bethpage: January, 1986.

Grumman Aerospace Corporation. Communication from J. Ohlmann to U.S. Environmental Protection Agency, Region II. Grumman Facilities Engineering Department, Bethpage: February, 1983.

Dvirka and Bartilucci, Consulting Engineers. Application for a RCRA Part B Permit, Volume 1. Syosset, New York: August, 1982, revised June, 1983.

Final Environmental Impact Statement: Proposed New York National Cemetery, Calverton, New York. Veteran's Administration, no date.

Reuter, Frederick H, et. al. Draft Environmental Impact Statement for the Proposed New York Pyrotechnic Company, Inc. Facility at Calverton, Town of

Brookhaven, County of Suffolk, State of New York: Hendersonville, NC: November, 1984.

Grumman Aerospace Corporation. Requisition and Invoice/Shipping Document regarding Destruction of Overage Explosives: Calverton, April, 1985.

Map of U.S. Naval Store House, Bethpage, Long Island, New York: Bethpage, 1950.

Map, Water Supply Systems. Grumman Aerospace Corporation, Facilities Department: Bethpage, 1980.

Map, Calverton General Plan. Grumman Aerospace Corporation, Facilities Department: Calverton, March, 1985.

Map, Plant #03 Shops. Bethpage: no date.

Ohlmann, John. Personal Communication regarding Chemical and Waste Storage Tanks, Plants 01, 02, and 03, Bethpage facility. Bethpage: April, 1981.

Wilson and Company, Engineers and Architects. Industrial Waste Treatment Facility, Navy Building No. 3, Volume IV, Sludge Processing and Disposal. Grumman Aerospace Corporation. January, 1980.

New York State Department of Environmental Conservation. SPDES - Discharges Monitoring Report for Grumman Aerospace Corp. Grumman Aerospace Corporation: Bethpage, 1985.

REFERENCE NO. 2

D-49-2-92-1

ROUGH DRAFT

REMEDIAL INVESTIGATION

REPORT

VOLUME I

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN)

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT BETHPAGE, NEW YORK

NORTHERN AND CHESAPEAKE DIVISIONS

CONTRACT N62472-90-D-1298, CTO 0003

JANUARY 1992

104

HALLIBURTON NUS
Environmental Corporation

D-49-2-92-1

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN)

ROUGH DRAFT

REMEDIAL INVESTIGATION REPORT

VOLUME I

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT

BETHPAGE, NEW YORK

NORTHERN AND CHESAPEAKE DIVISIONS

Submitted to:
Northern Division
Environmental Branch, Code 1423/FK
Naval Facilities Engineering Command
Building 77-L, U.S. Naval Base
Philadelphia, PA 19112-5094

Submitted By:
HALLIBURTON NUS Environmental Corporation
Foster Plaza 7
661 Andersen Drive
Pittsburgh,PA 15220

CONTRACT N62472-90-D-1298, CTO 0003

JANUARY 1992

Submitted By:

Approved for Submittal By:

David D. Brayack, P.E.
Project Manager

John J. Trepanowski, P.E.
Program Manager

105

TABLE OF CONTENTS

106

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

PAGE

TABLES

110

TABLE OF CONTENTS (Cont'd)

PAGE

TABLES

///

TABLE OF CONTENTS (Cont'd)

PAGE

PAGE

FIGURES

112

TABLE OF CONTENTS (Cont'd)

PAGE

PAGE

APPENDICES

2.0 STUDY AREA INVESTIGATION

This section presents the basis for the RI scoping and a description of each of the field investigation tasks performed at the site to meet the objectives of the RI.

Between August 19, 1991 and January 29, 1992, the following field activities were conducted:

- Soil-gas survey and analysis of samples at 73 locations (Section 2.2).
- Drilling and installing 29 temporary wells and sampling and analysis of the groundwater (Section 2.3).
- Sampling and analysis of 48 subsurface soil samples at 29 locations and 29 surface soil locations (Section 2.4).
- Drilling and installation of 17 monitoring wells (Section 2.5).
- Groundwater sampling and analysis from selected existing monitoring and production wells and newly installed monitoring wells (Section 2.6).
- Surface water and sediment sampling and analysis from existing recharge basins (Section 2.7).
- Water-level measurements of groundwater obtained from monitoring wells (Section 2.8).
- Surveying the locations and vertical elevations of all newly installed monitoring wells, USGS well, and soil-gas points (Section 2.9).

2.1 Scoping of Remedial Investigation

This section presents a summary of existing analytical data, data limitations and requirements, and data quality objectives.

2.1.1 Summary of Historic Analytical Data

The two media which are potentially contaminated at the Bethpage activity are soil and groundwater. No data are available on the potential soil contamination. However, there is a significant amount of data available on regional groundwater contamination (G&M, 1990). The Grumman Work Plan presents results of volatile organic testing of groundwater from monitoring wells within a 3-mile radius of the activity. The sample dates varied from 1982 to

114

1989. The location of the wells, a description of the wells, the detailed analytical data are presented in Appendix A. The f volatile organics detected in the groundwater at the high concentrations and greater frequency are as follows:

MAXIMUM VOLATILE ORGANIC CONCENTRATIONS IN GROUNDWATER

Parameter	Concentration (ug/l)	Location
Trichloroethene	1,600	Well 7635
Tetrachloroethene	2,400	Well 10595
1,1,1-Trichloroethane	650	Well 10595
1,1-Dichloroethane	160	Well 10595
1,2-Dichloroethane	340	Well 10629

Wells 10595 and 10629 are located about 400 feet south of Site Well 7635 is located about 1300 feet southwest of Site 3 (S Figure 2-1). Analytical data on wells located on or near the Na property are summarized as follows:

GROUNDWATER ANALYTICAL DATA FOR WELLS ON THE NWIRP MAXIMUM CONCENTRATIONS (ug/l)

Parameter	Well 10623 (USGS Well)	Well 7637	Well 7636	Well 10625	Well 8816	Well 7535	Well 8643	Well 10594
Screened Interval (ft)	68-72	-	-	-	-	-	-	73-76
Trichloroethene	580	14	54	120	35	150	37	440
Tetrachloroethene	550	6	5	25	6	160	120	ND
1,1,1-Trichloroethane	260	2	9	31	4	130	1	4
Vinyl Chloride	21	1	3	1	4	4	3	1
1,1-Dichloroethane	26	ND	ND	2	ND	ND	ND	ND
1,1-Dichloroethene	38	ND	ND	ND	ND	-	-	ND
1,2-Dichloroethene	130	ND	ND	ND	ND	-	-	ND

ND: None detected
-: Indicates that data are not available

115

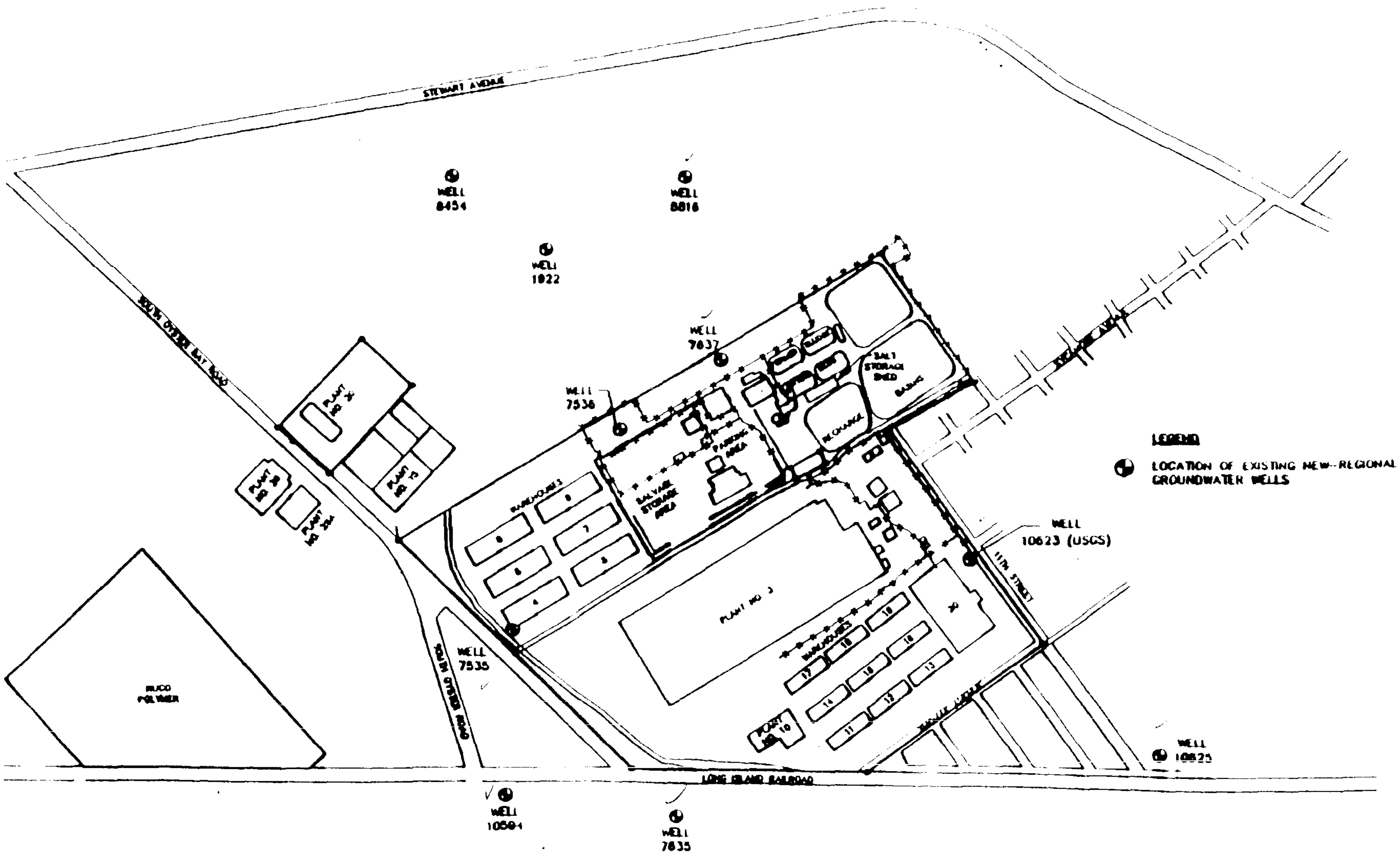


FIGURE 2-1

0 500 1000
SCALE IN FEET

LOCATION OF EXISTING NEW-REGIONAL GROUNDWATER WELLS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation

116

There is currently analytical data on only one additiona groundwater well located within 1000 feet north of the Nav property (Well 8454 is believed to be hydraulically upgradient o the NWIRP). This well was found to have low (less than 10 ug/l) o nondeductible concentrations of volatile organics.

Only minimal data were available on potential metal an semivolatile organic contamination in the groundwater. In 1956 the recharge basin water for Plant No. 3 was measured to contai 0.24 parts per million (ppm) of hexavalent chromium and 0.04 ppm o cadmium.

2.1.2 Data Limitations and Requirements

The existing analytical data focused on volatile organi contamination in groundwater on a regional basis; there were n data available for soil contamination.

Additional data was required to identify the nature and extent o soil and groundwater contamination on the NWIRP and to assess risk to human health and the environment. To identify the nature an extent of contamination, analytical testing of surface an subsurface soils, recharge basin water and sediment, an groundwater was required. The history of the sites indicated tha there was the potential for these media to be contaminated wit volatile organics, semivolatile organics, metals, and cyanide. Also, there was the potential for PCBs and pesticides to be present in the soils.

A preliminary assessment of risk to human health and the environment at the NWIRP Bethpage site revealed two potentia exposure pathways: direct contact of contaminated media b activity personnel and contaminant migration within the groundwater. The direct contact risks can occur as a result o accidental ingestion of contaminated soils or groundwater, an inhalation of dust or organics volatilized from groundwater. Th contaminant migration occurs as a result of precipitatio infiltration contacting contaminated soils and leaching contaminants into the groundwater, recharge basin water discharge to groundwater and interactions with potentially contaminated sediments, and groundwater migration.

Since there was minimal data available regarding the source and location of potential soil and groundwater contamination, a phased approach is planned to optimize soil and groundwater testing efforts. To accomplish this, three phases would be used. These phases would overlap to minimize schedule delays. The first phase would be a site-wide soil-gas survey coupled with a field GC to initially identify potential areas of subsurface soil and/or groundwater contamination. The second phase would be to collect groundwater samples for field GC analysis and soil samples for fixed-base laboratory analysis. The field GC groundwater analysis results would be used to select the location of the permanent groundwater monitoring wells. The soil samples would be used to quantify soil contamination. The third phase would be used to collect groundwater samples for fixed-base laboratory analysis to quantify groundwater contamination. During the third phase, sampling and analysis of the Recharge Basins sediment and surface water, wastes at the former sludge drying beds (if present), and surface soils would be conducted to characterize the contamination potential contamination of these media. The basis for selecting the fixed-base analytical parameters for each media is presented in Table 2-1.

Additional data was required regarding the groundwater flow patterns at the NWIRP and how the groundwater interacts with the surrounding areas. To accomplish this, water-level measurements and pumping/slug tests are typically required. The water-level are being conducted at the adjacent Grumman Plant and should be applicable to the NWIRP, however additional measurements at the NWIRP will be required. The pump tests will be conducted at a later time, if necessary.

2.1.3 Data Quality Objectives

The overall objective of the RI will be to characterize the nature and extent of potential environmental contamination and associated risks to human health and the environment at the NWIRP. The data collected will also be used to evaluate potential remedial options. The specific objectives for the Bethpage plant are to identify the location and concentration of potential solvent and metal contamination of soil and groundwater at three sites identified in the Initial Assessment Study (RGH 1986) and to determine whether these sites are the source of a trichloroethene (TCE) contaminated groundwater plume in the Bethpage area. The NWIRP, Grumman, and RUCO are potential sources of this contamination.

The uses of the data collected are to characterize the nature and extent of contamination, to assess the potential risks to human health and the environment, and, for engineering purposes, to develop remedial actions. The nature and extent of contamination will include the areas and depths of contamination and contaminant concentrations. The risk assessment will address the contaminants, receptors, and pathways for exposure. The engineering parameters were selected based on potential remedial actions including groundwater pump-and-treat options and soil treatment/offsite disposal options.

The NWIRP Bethpage is not currently on the CERCLA National Priorit) List (NPL). However, it is possible that the site may be placed o: the NPL list and that legal actions may be taken in the future. I: accordance with Naval Energy and Environmental Support Activit) (NEESA), for sites which are on or about to be placed on the NPL, Data Quality Objective (DQO) Level D quality control and CL: methods and protocol are to be used. These sites are typicall) near populated areas and are likely to undergo litigation.

DQO Level D QC includes review and approval of the laboratory Q: Plan, the site work plan, and the field QA plan. The laborator) must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthl) progress reports on QA. The laboratory that performs Level D Q(must have passed the performance sample furnished through the Superfund Contract Laboratory Protocol (CLP) and must be able t(generate the CLP deliverables.

2.2 Soil-Gas Survey

The soil-gas survey was performed to identify potential soil and groundwater contamination. The survey consisted of a uniform gric of soil-gas samples in each of the three sites. A grid spacing of 150-foot centers was used. In addition, opportunity locations were selected in the field, based on results from grid pattern soil-gas locations, as well as areas of suspected gas sampling point locations. At each location, soil-gas samples were obtained at two depths- 5 feet and 21 feet. The 5-foot depth represents potential contamination in the soil near the source of a spill. Elevated soil-gas measurements at this depth would likely be an indication of surface soil contamination. The 21-foot depth represents the practical depth of this technique and the result would likely be influenced by both soil and groundwater contamination. The samples were analyzed in the field using a portable gas chromatograph equipped with an electron capture detector (GC/ECD). Based on this testing, temporary well point sample locations and soil sample locations and depths were selected. If minimal or no elevated soil-gas readings were found for any particular site, then temporary well sample points were located primarily along the upgradient and downgradient boundaries of that site. If elevated soil-gas readings were found, then 2 to 3 temporary well points were located along the hydraulic downgradient boundary of the site; 2 to 3 temporary well points were located along the hydraulic upgradient border of the site; and 3 to 4 temporary well points were located in the center of the contamination of the site.

Soil-gas samples were collected at a total of 73 locations over the NWIRP. Sixteen samples were taken at Site 1, twenty-five samples were taken at Site 2, and thirty-two samples were taken at Site 3.

TABLE 2-1

BASIS OF ANALYTICAL TESTING
NWIRP, BETHPAGE, NEW YORK

Site	Sample Type	Number of Samples	Rationale
1	Soils	Five to ten borings to be located in the field based on the results of the soil-gas testing with one to two samples per boring. Samples will be collected at depths where elevated soils gas readings were detected. Sample depths will be at 5 feet and/or 21 feet. Surface samples will be collected in a grid pattern with two additional samples selected based on apparent visual contamination. Analysis: TCL VOA on all samples plus SVOA, TCL metals, and cyanide on samples collected at the surface and at a depth of five feet. TCL PCBs and pesticides will also be conducted on visually stained soils. CLP procedures will be used.	Site 1 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. PCB-filled transformers and pesticides may also have been stored at the area. Residual soil contamination may remain at the site. Two of the samples will be tested for the general engineering/ remediation parameters of TOC, bulk density, grain size, moisture content, and pH.
	Groundwater	Three well clusters to be located in the field based on soil-gas and temporary monitoring well testing with two to three wells per cluster and one sample per well. Well clusters to be located along the hydraulic upgradient and downgradient borders of the site. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 1 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Any potential spills may have migrated to the groundwater. One sample will be analyzed for the general engineering/remediation parameters of TDS, alkalinity, hardness, BOD, TOC, and TSS.
2	Soils	Five to ten borings to be located in the field based on the results of the soil-gas testing with one to two samples per boring. Samples will be collected at depths where elevated soils gas readings were detected. Sample depths will be at 5 feet and/or 21 feet. Surface samples will be collected in a grid pattern with two additional samples selected based on apparent visual contamination. Analysis: TCL VOA on all samples plus SVOA, TCL metals, and cyanide on samples collected at the surface and at a depth of five feet. TCL PCBs and pesticides will also be conducted on visually stained soils. CLP procedures will be used.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant waste waters and sludges. These sludges were dried on site prior to offsite disposal. PCB-filled transformers and pesticides may also have been stored at the area. Residual soil contamination may remain at the site. Two of the samples will be tested for the general engineering/ remediation parameters of TOC, bulk density, grain size, moisture content, and pH.

TABLE 2-1
PAGE TWO

Site	Sample Type	Number of Samples	Rationale
2	Groundwater	Two well clusters to be located in the field based on soil-gas and temporary monitoring well testing with one to two wells per cluster and one sample per well. Well clusters to be located along the hydraulic upgradient and downgradient borders of the site. A Grumman well cluster may be usable as an additional upgradient data point and a Site 1 well cluster may be usable as an additional down gradient data point. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant waste waters and sludges. These sludges were dried on site prior to off site disposal. Any releases of contaminants may have migrated to the groundwater. One sample will be analyzed for the general engineering/remediation parameters of TDS, alkalinity, hardness, BOD, TOC, and TSS.
	Surface Water	Collect two surface water samples from the influent to the operating basin. One sample is to be collected during normal operations, and one sample is to be collected during a precipitation event. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant waste waters and sludges. These sludges were dried on site prior to offsite disposal. Currently it is reported that this water is noncontact; . however, this classification needs to be confirmed. The precipitation event sample would be collected to determine whether contaminated runoff is entering the basins.
	Sediment	Sample three recharge basins with two samples per basin. Analysis: TCL VOA and SVOA, TCL metals, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant wastewaters and sludges. These sludges were dried on site prior to offsite disposal. These sediments may be contaminated from past practices or from periodic current contamination.
	Waste	If encountered during drilling activities, take one sample of the waste in the former sludge-drying areas. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant wastewaters and sludges. These sludges were dried on site prior to off site disposal. There is no evidence that the sludges remain at the site, however, if during the drilling program sludges are encountered, they will be sampled.

TABLE 2-1
PAGE THREE

Site	Sample Type	Number of Samples	Rationale
3	Soils	Five to ten borings to be located in the field based on the results of the soil-gas testing with one to two samples per boring. Samples will be collected at depths where elevated soils gas readings were detected. Sample depths will be at 5 feet and/or 21 feet. Surface samples will be collected in a grid pattern with two additional samples selected based on apparent visual contamination. Analysis: TCL VOA on all samples plus SVOA, TCL metals, and cyanide on samples collected at the surface and at a depth of five feet. TCL PCBs and pesticides will also be conducted on visually stained soils. CLP procedures will be used.	Site 3 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Site 3 was also used to store fixtures, tools, and metallic wastes. There are also reports of surface oil contamination. PCB-filled transformers and pesticides may also have been stored at the area. Residual soil contamination may remain at the site. Two of the samples will be tested for the general engineering/ remediation parameters of TOC, bulk density, grain size, moisture content, and pH.
	Groundwater	Two to three well clusters. One well cluster will be located southwest of Plant 3. This well point will be used to fill in a data gap for the overall Bethpage plant. The second cluster will be located downgradient of Site 3 and the third cluster (if necessary) will be located upgradient of Site 3. Exact locations for the two well cluster at Site 3 will be determined in the field based on soil-gas and temporary monitoring well testing with two wells per cluster and one sample per well. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6} and cyanide using CLP procedures.	Site 3 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Site 3 was also used to store fixtures, tools, and metallic wastes. There are also reports of surface oil contamination. These contaminants may have migrated into the groundwater. One sample will be analyzed for the general engineering/remediation parameters of TDS, alkalinity, hardness, BOD, TOC, and TSS.
None	Groundwater	Collect one groundwater sample from each of four operating production wells and the USGS well located at the NWIRP in Bethpage. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	These samples will provide an indication of local groundwater quality at the NWIRP.

122

Shallow (5 foot) and deep (21 foot) samples were collected at eac location. To collect the samples, a van-mounted hydraulic prob was used to advance connected 3 foot sections of 1-inch diamete threaded steel casing down to a depth of 5 feet. The entir sampling system was purged with ambient air drawn through a organic vapor filter cartridge. A teflon line was inserted int the casing to the bottom of the hole, and the bottom-hole lin perforations were isolated from the up-hole annulus by a inflatable packer. A sample of in-situ soil-gas was then withdraw through the probe and used to purge atmospheric air from th sampling system. A second sample of soil-gas was withdrawn throug the probe and encapsulated in a pre-evacuated glass vial at tw atmospheres of pressure (15 psig). The self-sealing vial wa detached from the sampling system, packaged, labeled, and store for laboratory analysis.

The hydraulic probe was then further advanced to a depth of 21 fee and a deep sample was collected in the same manner as above.

Prior to the day's field activities all sampling equipment an probes were decontaminated by washing with soapy water and rinsin thoroughly. Internal surfaces were flushed dry using pre-purifie nitrogen or filtered ambient air, and external surfaces were wipe clean using paper towels. After the collection of each sample, al equipment which contacted the soil (the stainless steel pipes) wa pressure washed prior to its reuse.

To document the decontamination procedure, field control sample were collected at the beginning of each day's field activities after every twentieth soil-gas sample, and at the end of each day' field activities. These QA/QC samples were obtained by insertin the probe tip into a tube flushed by a 20 psi flow of pre-purifie nitrogen and collecting a sample in the manner described above Field Control Samples 101, 102, 109, 201, 224, 301, 302 and 33 were collected at the beginning of the day's field activities Field Control Samples 106, 107, 114, 222, 323, 330, 331 and 34 were collected at the end of the day's field activities. Se Tables 2-1, 2-2, and 2-3 for QA/QC sample results. See Table 2- for a comparison of mobile versus fixed-base results.

Soil-gas survey results indicate contamination at all three site in both the shallow and deep sampling points (see Figures 2-2 an 2-3). Analysis was performed on seven chlorinated hydrocarbons Results for trichloroethene (TCE), tetrachloroethene (PCE), an 1,1-dichloroethene (DCE) were the greatest, with concentrations a high as 832 ug/l.

2.2.1 Site 1

Site 1 contained the highest soil-gas readings (Table 2-1 for soil gas results). DCE readings were as high as 728 ug/l in the dee samples and 832 ug/l in the shallow samples. Total TCE+PC readings were greater than 100 ppm. The high concentration readings in the shallow samples are located at the former drum marshaling area. This may be a result of surface spills. The high concentrations in the deep samples occur in the former drum marshaling area and downgradient of the former drum marshaling area. This may be due to outgassing of a plume which has migrated downgradient. One interesting result is the relatively "clean" analysis at location 110. This point corresponds to the most contaminated shallow groundwater sampled by either the temporary well points or the permanent monitoring wells. It is hypothesized that the numerous thin clayey intervals at this location (as open in the borings) may prevent the upward migration of the gas-phase contaminants.

2.2.2 Site 2

Soil-gas results for Site 2 (see Table 2-3) indicate low levels of contamination with the highest concentrations in the vicinity of the former sludge drying beds. Contamination consists of DCE with a maximum concentration of 20 ug/l, TCE with a maximum concentration of 11 ug/l, and PCE with a maximum concentration of 0.85 ug/l.

2.2.3 Site 3

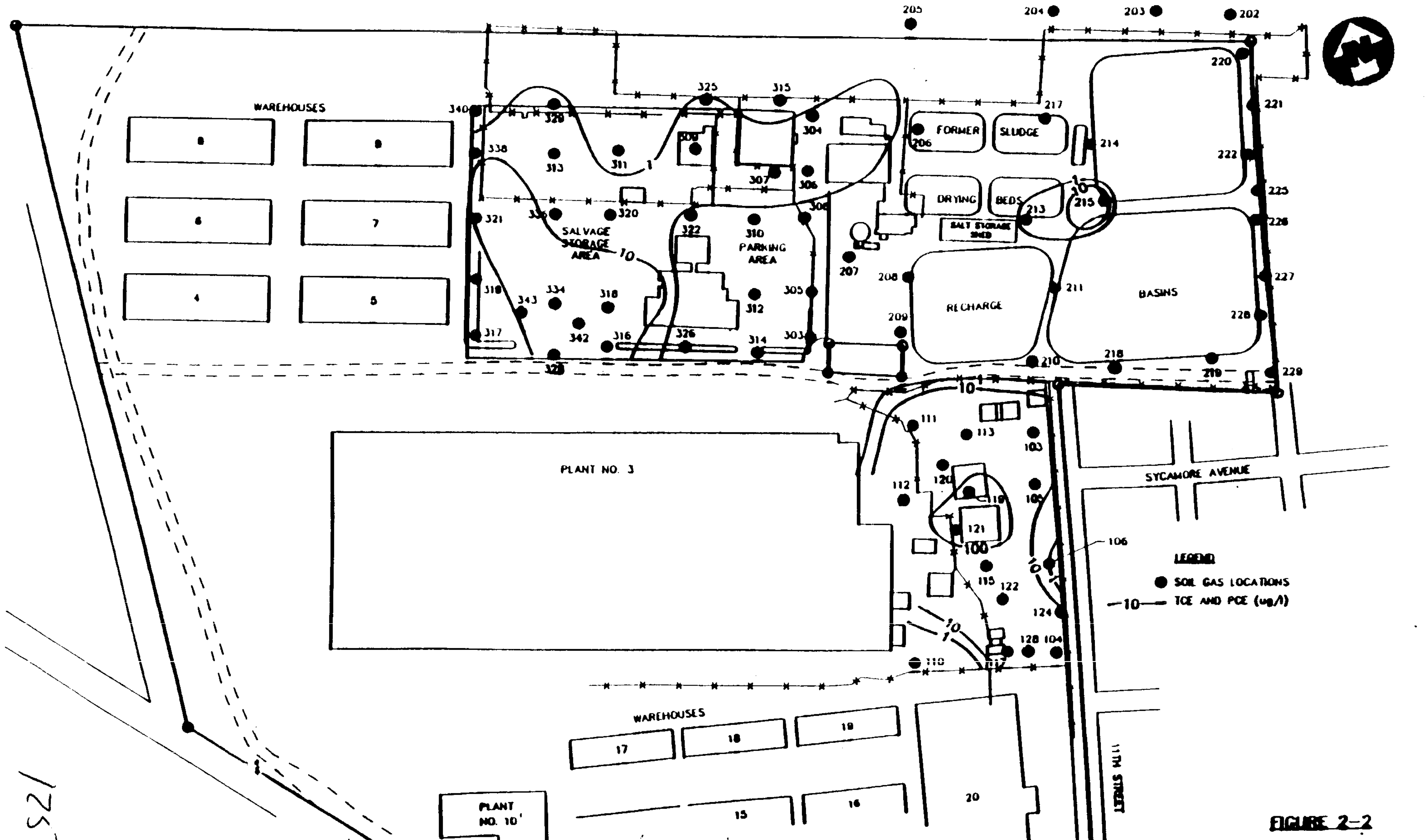
Soil-gas results for Site 3 (see Table 2-4) indicate moderate levels of contamination with the highest concentration in the southwest corner and northeast portion of the parking area. Contamination consists of DCE with a maximum concentration of 179 ug/l, TCE with a maximum concentration of 47 ug/l, and PCE with a maximum concentration of 54 ug/l.

2.3 Temporary Monitoring Well Survey

2.3.1 Field Activities

A temporary monitoring well survey was conducted to aid in the placement of the permanent monitoring wells. The temporary well points were selected based on the results of the soil-gas survey. Twenty-nine temporary wells were installed, sampled, and analyzed for the following parameters: Vinyl chloride; 1,1,-Dichloroethene; trans-1,2-Dichloroethene; 1,1-Dichloroethane; cis-1,2-Dichloroethene; 1,1,1-Trichloroethane; 1,2-Dichloroethane; Trichloroethene; Tetrachloroethene. The location of the temporary wells is illustrated in Figure 2-4).

The temporary wells were drilled with a Mobil B-57 drilling rig. Hollow stem augers were used to advance the borings through the overburden with a minimum borehole diameter of 6 inches. All 29 temporary wells were screened in the shallow part of the overburden aquifer. The well point consisted of a 2-inch well screen installed through the hollow stem auger; the augers were pulled

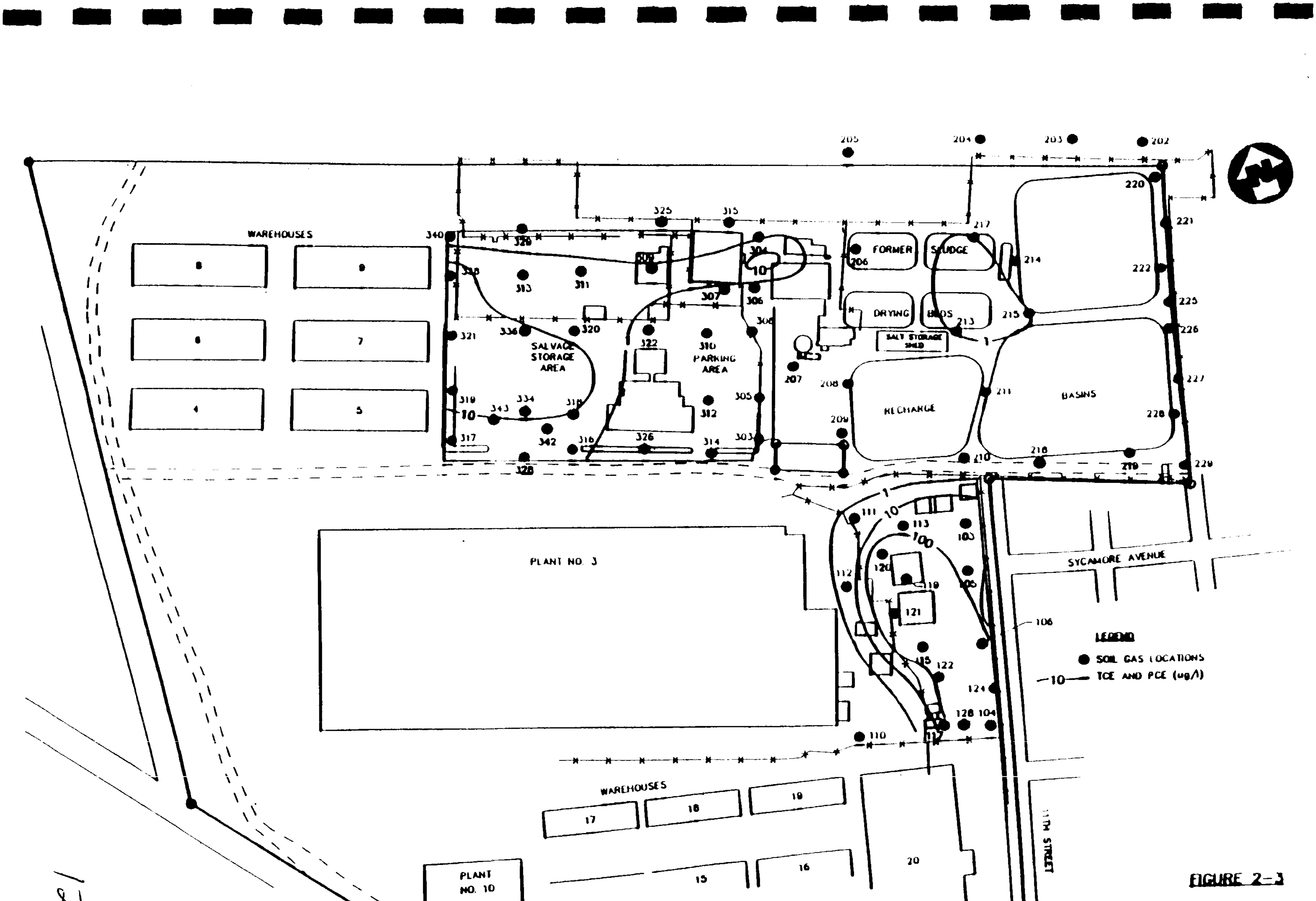


125

FIGURE 2-2

SOIL GAS RESULTS – SHALLOW
REMEDIAL INVESTIGATION

HALLIBURTON NUS



0 200 400
SCALE IN FEET

FIGURE 2-3

SOIL GAS RESULTS – DEEP
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

126

TABLE 2-2
SOIL-GAS RESULTS - SITE 1 (ug/l)
NWIRP, BETHPAGE, NY

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
103D	192	<1.0	2.7	1.6	18	15	11
103S	44	<1.0	<1.0	3.6	5.6	13	9.6
104D	7.4	<1.0	3.7	<1.0	89	143	5.7
104S	<1.0	<1.0	<1.0	<1.0	0.31	0.68	<0.05
105D	244	<1.0	<1.0	<1.0	14	9.7	27
105S	187	<1.0	<1.0	<1.0	9.9	7.7	19
106D	<1.0	<1.0	<1.0	<1.0	0.22	1.2	0.12
106S	6.1	<1.0	<1.0	<1.0	1.6	3.5	3.5
110D	3.6	<1.0	<1.0	<1.0	0.11	<0.10	0.78
110S	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	0.65
111D	59	<1.0	<1.0	<1.0	6.4	6.7	3.6
111S	125	<1.0	<1.0	<1.0	8.8	7.8	1.9
112D	85	<1.0	1.7	<1.0	9.0	4.9	6.7
112S	61	<1.0	<1.0	<1.0	9.4	3.7	9.4
113D	174	<1.0	<1.0	<1.0	15	11	16
113S	131	<1.0	<1.0	<1.0	8.3	15	12
115D*	80	<1.0	2.4	4.4	8.8	18	<0.05
115S	20	<1.0	<1.0	<1.0	9.5	14	70
117D	14	<1.0	<1.0	<1.0	26	40	21
117S	7.4	<1.0	<1.0	<1.0	10	18	14
119D	165	<1.0	3.1	26	24	21	70
119S	626	<1.0	6.9	37	70	63	138
120D	728	<1.0	18	16	107	45	174
120S	832	<1.0	30	48	122	68	479
121D	558	<1.0	19	50	101	96	617
121S	568	<1.0	21	48	125	159	765
122D	46	<1.0	<1.0	<1.0	19	19	77
122S	8.6	<1.0	<1.0	<1.0	6.4	17	35
123D	11	<1.0	3.9	<1.0	78	139	19
123S	4.9	<1.0	<1.0	<1.0	39	56	14
124D	11	<1.0	<1.0	<1.0	13	16	20
124S	2.7	<1.0	<1.0	<1.0	2.4	1.2	4.8

TABLE 2-2
SOIL-GAS RESULTS-SITE 1 (ug/l)
PAGE TWO

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
FIELD CONTROL SAMPLES							
101	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
102	<1.0	<1.0	<1.0	<1.0	<0.10	0.14	<0.05
107	<1.0	<1.0	<1.0	<1.0	<0.10	0.11	<0.05
108	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
109	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
114	<1.0	<1.0	<1.0	<1.0	<0.10	<0.1	0.09
125	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.40
LABORATORY DUPLICATE ANALYSES							
106D	<1.0	<1.0	<1.0	<1.0	0.22	1.2	0.12
106DR	<1.0	<1.0	<1.0	<1.0	0.20	1.3	0.13
110D	3.6	<1.0	<1.0	<1.0	0.11	<0.10	0.78
110DR	3.1	<1.0	<1.0	<1.0	<0.10	<0.10	0.47
113D	174	<1.0	<1.0	<1.0	15	11	16
113DR	165	<1.0	<1.0	<1.0	14	7.4	15
LABORATORY BLANKS							
106DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
110DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
113DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

* = SAMPLES MAY CONTAIN HIGHER CONCENTRATIONS OF 111TCA, TCE, AND/OR PCE

11DCE = 1,1-dichloroethene
11DCA = 1,1-dichloroethane
111TCA = 1,1,1-trichloroethane
PCE = tetrachloroethene

t12DCE = trans-1,2-dichloroethene
c12DCE = cis-1,2-dichloroethene
TCE = trichloroethene

S = Shallow
D = Deep

TABLE 2-3
SOIL-GAS RESULTS - SITE 2 (ug/l)
NWIRP, BETHPAGE, NY

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
202D	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
202S	<1.0	<1.0	<1.0	<1.0	0.39	<0.10	<0.05
203D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
203S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
204D	<1.0	<1.0	<1.0	<1.0	<1.10	<0.10	<0.05
204S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
205D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.07
206D	6.3	<1.0	<1.0	<1.0	<0.10	0.32	0.05
206S	1.2	<1.0	<1.0	<1.0	0.19	2.2	0.85
207D	2.8	<1.0	<1.0	<1.0	<0.10	<0.10	0.60
207S	20	<1.0	<1.0	<1.0	<0.10	0.21	0.11
208D	1.4	<1.0	<1.0	<1.0	<0.10	<0.10	0.41
208S	4.3	<1.0	<1.0	<1.0	0.17	0.54	0.25
209D	1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.06
209S	1.4	<1.0	<1.0	<1.0	<0.10	<0.10	0.17
210D	1.4	<1.0	<1.0	<1.0	<0.10	0.12	0.23
210S	1.2	<1.0	<1.0	<1.0	<0.10	<0.10	0.41
211D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
211S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.50
213D	5.1	<1.0	<1.0	<1.0	1.3	2.2	0.42
213S	3.1	<1.0	<1.0	<1.0	1.0	0.88	0.18
214D	<1.0	<1.0	<1.0	<1.0	0.36	<0.10	<0.05
214S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
215D	6.4	<1.0	<1.0	<1.0	0.46	1.8	0.27
215S	1.3	<1.0	<1.0	<1.0	0.34	11	0.22
216D	1.2	<1.0	<1.0	<1.0	<0.10	<0.10	0.09
216S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.28
217D	<1.0	<1.0	<1.0	<1.0	0.33	1.8	0.11
217S	<1.0	<1.0	<1.0	<1.0	<0.10	0.12	<0.05
218D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
218S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
219D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
219S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

back to expose the screen. All temporary wells were constructed with 2-inch inside diameter, Schedule 40, flush-joint threaded polyvinyl chloride (PVC) pipe and a 10-foot length of PVC screen with a slot size of 0.010 inches, capped at the bottom by a PVC end plug. The well point was purged a minimum of 3 volumes with a stainless steel bailer and a sample was collected using the bailer.

2.3.2 Temporary Well Groundwater Analysis

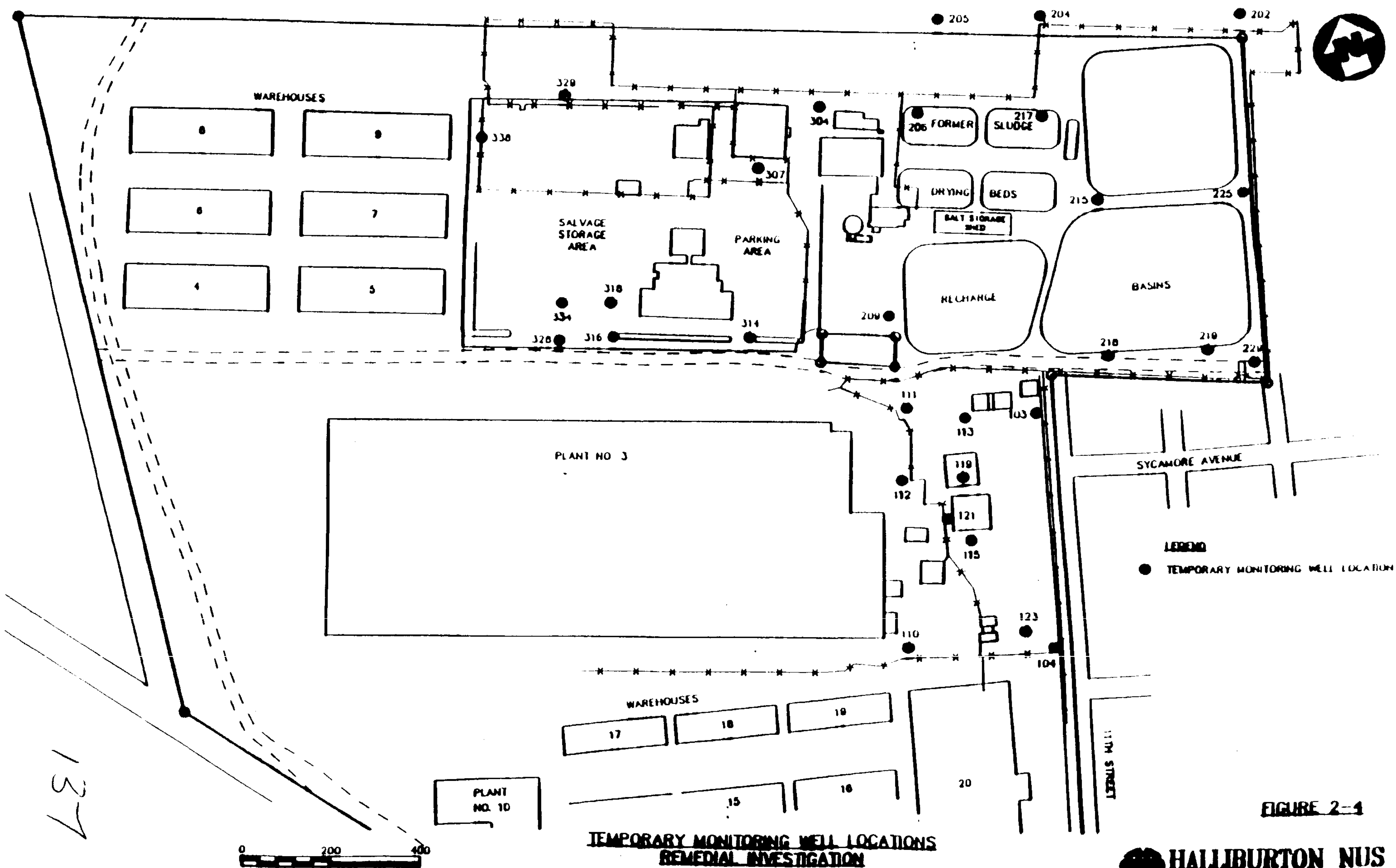
29 temporary wells were sampled and analyzed for the following volatile organics at the site: Vinyl chloride; 1,1-Dichlorethene (1,1-DCE); trans-1,2-Dichloroethene (t-1,2-DCE); 1,1-Dichloroethane (1,1-DCA); cis-1,2-Dichloroethene (c-1,2-DCE); 1,1,1-Tichloroethane (1,1,1-TCA); 1,2-Dichloroethane (1,2-DCA); Trichloroethene (TCE); Tetrachloroethene (PCE). A summary of the organic contaminants detected is provided in Table 2-6. PCE, 1,1,1-TCA and TCE were present as the highest concentrations and were the most abundant contaminants. Concentrations were present as high as 7,700 ug/l.

2.3.2.1 Site 1

Groundwater Site 1 had the highest concentration readings and number of contaminated temporary wells. Site 1 also contained the two most contaminated wells- G-110 (located downgradient of the site), and G-121 (located in the source area). PCE was present at a maximum concentration of 7,700 ug/l in temporary well G-121. It was also found at concentrations greater than 700 ug/l in temporary wells located in the former drum marshaling area and in the downgradient direction. TCE was present at a maximum concentration of 1,900 ug/l in well G-123. It was also found at concentrations greater than 100 ug/l in temporary wells located in the former drum marshaling area and in the downgradient direction. 1,1,1-TCA was present at a maximum concentration of 5,400 ug/l in temporary well G-110. It was also present at concentrations greater than 100 ug/l in the former drum marshaling area and in the downgradient direction. C-1,2-DCE was present at a maximum concentration of 1,500 ug/L in well G-110. It was also present at concentrations greater than 100 ug/l in temporary wells located in the source area. 1,1-DCA was present at a maximum concentrations of 620 ug/l in temporary well G-110. It was also present at concentrations of greater than 100 ug/l in the former drum marshaling area and in the downgradient direction. 1,1-DCE was present at a maximum concentration of 100 ug/l at temporary well G-110. It was also found in lesser concentrations in the former drum marshaling area and in the downgradient direction.

2.3.2.2 Site 2

TCE was the only volatile organic detected at Site 2, was present at a low concentration (9 ug/l), and only detected in 4 temporary wells. Two wells contained the maximum concentration of 9 ug/l (G-



137

FIGURE 2-4

TEMPORARY MONITORING WELL LOCATIONS
REMEDIAL INVESTIGATION

HALLIBURTON NUS

209, G-218). Both wells were located in the southern portion of the site.

2.3.2.3 Site 3

TCE was the most abundant contaminant found in Site 3. It was detected in 8 wells with a maximum concentration of 76 ug/l in G-328. It was also found throughout the site (in lesser concentrations), in no distinct patterns. G-328 (located in the downgradient direction) contained maximum concentrations of C-1,2-DCE of 31 ug/l, TCE of 76 ug/l, and PCE of 57 ug/l. Lesser concentrations of these contaminants were found throughout the site in no distinct patterns. Low levels of 1,1,1-TCA and 1,1-DCA were also detected.

2.4 SOIL SAMPLING

2.4.1 Subsurface Soil Sampling and Analysis

Forty-eight subsurface soil samples and 4 duplicate samples were collected at 29 temporary monitoring well locations during temporary well drilling operations. The locations of the soil borings are presented in Figure 2-5.

The subsurface soil samples were collected at a depth of 3 to 5 feet and/or 19 to 21 feet. For each location, the decision to sample was dependent on the soil-gas measurement at that location and depth. In general, if volatile organics were detected at that point, then a soil sample was obtained for offsite fixed-base laboratory analysis. If volatile organics were not detected at that point, then a soil sample was not obtained. However, several soil samples were collected at points where soil-gas measurements indicated the absence of soil contamination. These samples were analyzed offsite at a fixed-base laboratory to confirm the absence of soil contamination.

The samples were collected by driving a 24-inch-outside diameter split-barrel sampler with repeated blows using a 140-pound weight falling a distance of 30 inches. A portion of the soil recovered was placed in appropriate jars for shipping and analysis. Sample log sheets for all soil samples are included in Appendix B.

All the samples were analyzed for TCL volatile organics. The near surface (3 to 5 feet deep) soil samples were also analyzed for semivolatile organics, TAL metals, and cyanide. Four samples identified as stained were also analyzed for PCBs and pesticides.

In addition to these chemical analyses, six select samples were evaluated for engineering parameters. Two samples were selected at each site plus one duplicate sample (for a total of 7), based on the field screening data. For each site, one sample represented a

138

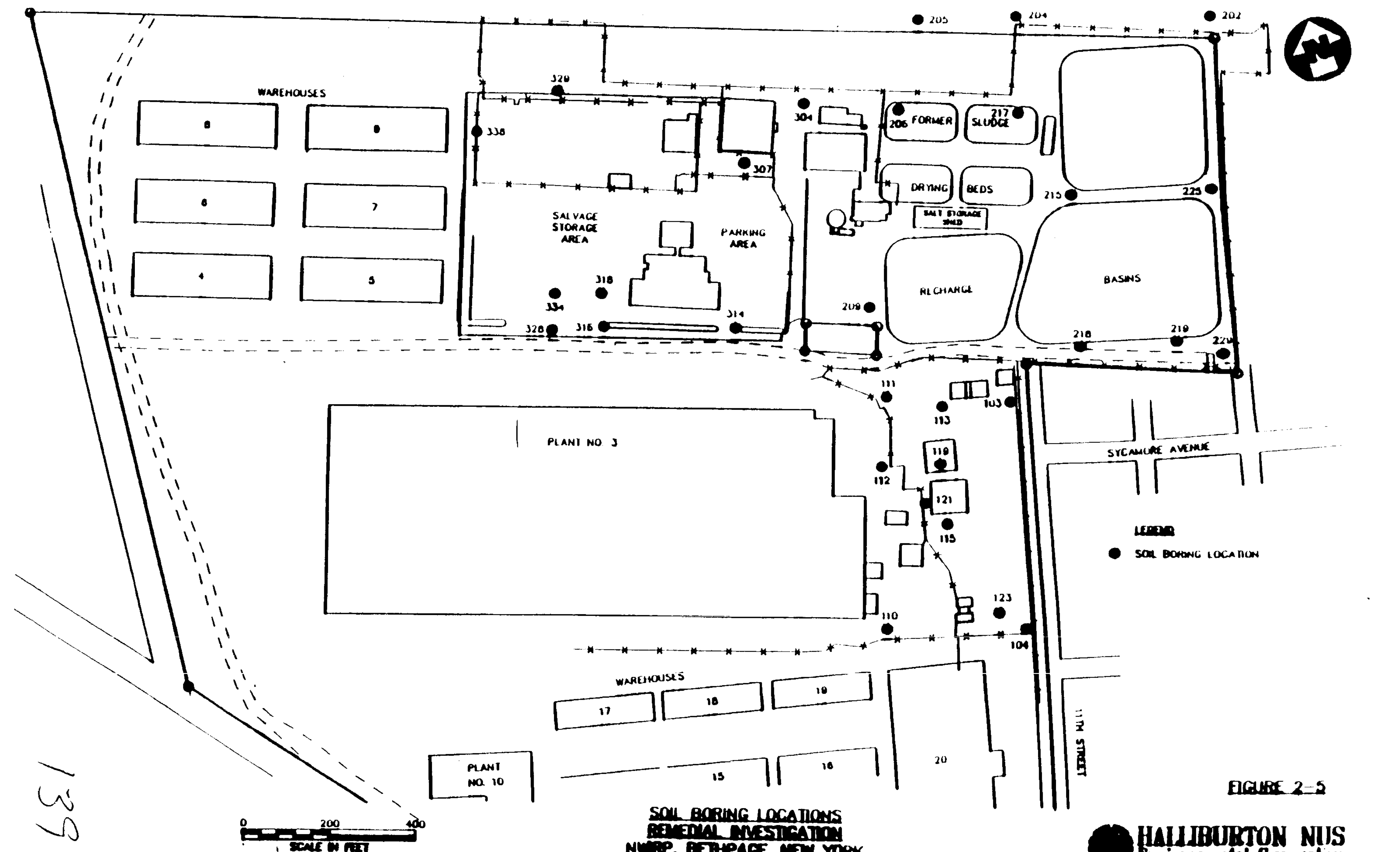


FIGURE 2-5

SOIL BORING LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

139

relatively low level of contamination, and the second sample represented an intermediate or high level of contamination. The engineering parameters consist of:

- Total organic carbon (TOC) to evaluate the potential for groundwater contamination through an estimate of the contaminant soil/water partition coefficient.
- Bulk density, grain size, moisture content, and pH for general engineering considerations.

2.4.2 Surface Soil Sampling

29 surface soil samples and 4 duplicate samples were collected from locations that consisted of points in a relatively uniform 300-foot by 300-foot grid plus field opportunity sample locations. In addition, 4 samples identified as stained were analyzed for PCBs and pesticides.

The surface soils sample locations are illustrated in Figure 2-6. There was a 2- point by 3-point grid at Site 1; a 3-point by 4-point grid at Site 2; and a 2-point by 3-point grid at Site 3. The opportunity samples were selected in the field during the sampling activities. Soils which appeared to be stained or visually discolored were selected. The samples were collected at a depth of 1 to 6 inches and were analyzed for TCL volatile and semivolatile organics, TAL metals, cyanide and PCBs/pesticides. The samples were collected with a stainless steel trowel and were placed in appropriate jars for shipping and analysis. The analytical results are discussed in Section 4.0 and the analytical data is presented in Appendix C. The chain-of-custody forms are provided in Appendix D.

2.5 Drilling and Monitoring Well Installation

Seventeen monitoring wells were installed to evaluate the impact of the three sites on the local groundwater quality and to assess the potential vertical and lateral migration of any contaminants. The potential vertical migration of the contaminants was investigated through the construction of well clusters composed of shallow (49- to 59-foot deep), intermediate (110-to 158-foot deep), and deep (195- to 230-foot deep) monitoring wells. These yield groundwater quality analyses from various depths and define the magnitude and direction of local vertical hydraulic gradients. The potential lateral migration of contaminants was investigated through the placement of wells both upgradient and downgradient from the sites. The results of the soil gas survey and the temporary wells were used to determine the location of the monitoring wells.

A total of 17 monitoring wells (7 shallow, 7 intermediate, and 3 deep) were installed at the NWIRP. The location of these monitoring wells is provided in Figure 2-7. The shallow wells were

TABLE 2-3
SOIL-GAS RESULTS - SITE 2 (ug/l)
PAGE TWO

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
220D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
220S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
221D	2.0	<1.0	<1.0	<1.0	<0.10	0.15	<0.05
221S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
222D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
222S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
225D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
225S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
226D	<1.0	<1.0	<1.0	<1.0	<1.10	<0.10	<0.05
226S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
227D	14	<1.0	<1.0	<1.0	0.59	<0.10	<0.05
227S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
228D	2.0	<1.0	<1.0	<1.0	0.11	0.18	0.19
228S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
229D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
229S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
FIELD CONTROL SAMPLES							
201	<1.0	1.0	2.0	<1.0	<0.10	<0.10	<0.05
212	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
224	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
LABORATORY DUPLICATE ANALYSES							
218D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
218DR	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223R	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
LABORATORY BLANKS							
218DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223B	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

11DCE = 1,1-dichloroethene
11DCA = 1,1-dichloroethane
111TCA = 1,1,1-trichloroethane
PCE = tetrachloroethene
t12DCE = trans-1,2-dichloroethene
c12DCE = cis-1,2-dichloroethene
TCE = trichloroethene

S = Shallow
D = Deep

TABLE 2-4
SOIL-GAS RESULTS - SITE 3 (ug/l)
NWIRP, BETHPAGE, NY

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
303D	3.7	<1.0	<1.0	<1.0	0.14	0.13	0.20
303S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.13
304D	43	<1.0	<1.0	<1.0	3.1	4.8	0.49
304S	17	<1.0	<1.0	<1.0	3.0	12	0.61
305D	14	<1.0	<1.0	<1.0	0.36	1.3	0.54
305S	3.3	<1.0	<1.0	<1.0	<0.10	0.21	0.12
306D	125	<1.0	<1.0	<1.0	37	9.7	0.67
306S	131	<1.0	<1.0	<1.0	46	12	0.67
307D	179	<1.0	<1.0	<1.0	48	9.2	0.76
307S	138	<1.0	<1.0	<1.0	60	10	0.97
308D	27	<1.0	<1.0	<1.0	0.54	0.87	0.46
308S	25	<1.0	<1.0	<1.0	0.51	0.52	0.33
309D	12	<1.0	<1.0	<1.0	0.37	0.28	1.4
309S	8.4	<1.0	<1.0	<1.0	0.19	0.37	2.3
310D	27	<1.0	<1.0	<1.0	0.30	<0.10	<.05
310S	23	<1.0	<1.0	<1.0	0.30	<0.10	<0.05
311D	14	<1.0	<1.0	<1.0	14	2.2	0.05
311S	1.0	<1.0	<1.0	<1.0	0.50	<0.10	<0.05
312D	23	<1.0	<1.0	<1.0	0.15	<0.10	<0.05
312S	28	<1.0	<1.0	<1.0	0.14	<0.10	<0.05
313D	4.3	<1.0	<1.0	<1.0	1.3	1.00	0.35
313S	10	<1.0	<1.0	<1.0	2.8	2.7	1.7
314D	11	<1.0	<1.0	<1.0	0.12	<0.10	<0.05
314S	9.6	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
315D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
315S	4.5	<1.0	<1.0	<1.0	0.82	0.63	<0.05
316D	33	<1.0	<1.0	<1.0	3.0	3.6	8.5
316S	21	<1.0	<1.0	<1.0	1.9	1.7	8.9
317D	8.7	<1.0	<1.0	[illegible].0	0.70	0.88	0.87
317S	23	<1.0	<1.0	<1.0	1.9	1.8	3.5
318D	65	<1.0	1.1	7.4	4.9	47	51
318S	74	<1.0	<1.0	3.4	5.1	38	54

131

TABLE 2-4
SOIL-GAS RESULTS - SITE 3 (ug/l)
PAGE TWO

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
319D	27	<1.0	<1.0	<1.0	2.3	4.4	9.6
319S	19	<1.0	<1.0	<1.0	1.7	4.0	2.7
320D	61	<1.0	<1.0	<1.0	3.8	0.95	0.93
320S	52	<1.0	<1.0	<1.0	3.0	0.23	1.0
321D	38	<1.0	9.3	20	11	17	4.4
321S	16	<1.0	1.8	3.6	5.8	15	2.6
322D	95	<1.0	<1.0	<1.0	2.1	0.35	0.24
322S	96	<1.0	<1.0	<1.0	2.4	0.28	0.31
325D	2.7	<1.0	<1.0	<1.0	0.22	0.12	0.49
325S	5.6	<1.0	<1.0	<1.0	0.63	0.32	0.89
326D	18	<1.0	<1.0	<1.0	0.23	<0.10	0.47
326S	5.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
327D	2.2	<1.0	<1.0	<1.0	<0.10	0.16	0.18
327S	3.8	<1.0	<1.0	<1.0	<0.10	0.20	0.34
328D	33	<1.0	<1.0	<1.0	2.4	9.7	2.8
328S	41	<1.0	<1.0	<1.0	4.0	4.9	5.5
329D	2.5	<1.0	<1.0	<1.0	<0.10	0.22	0.06
329S	2.6	<1.0	<1.0	<1.0	0.17	<0.10	0.08
334D	28	<1.0	11	1.6	3.5	13	12
334S*	50	<1.0	16	4.3	5.3	17	<0.05
336D	45	<1.0	3.9	<1.0	6.2	7.4	5.0
336S	26	<1.0	<1.0	<1.0	4.0	3.8	4.3
338D	42	<1.0	5.5	30	15	17	24
338S	28	<1.0	2.1	12	6.8	13	8.6
340D	5.4	<1.0	<1.0	<1.0	2.1	0.18	0.12
340S	<1.0	<1.0	<1.0	<1.0	0.15	0.16	0.16
341D*	71	<1.0	<1.0	<1.0	2.2	7.2	6.5
341S	39	<1.0	<1.0	<1.0	1.0	1.9	5.2
342D	18	<1.0	<1.0	<1.0	1.9	3.2	4.2
342S	31	<1.0	<1.0	<1.0	2.8	4.2	12
343D	9.5	<1.0	1.6	<1.0	1.1	1.5	1.6
343S	33	<1.0	<1.0	7.7	3.3	4.4	6.2

TABLE 2-4
SOIL-GAS RESULTS - SITE 3 (ug/l)
PAGE THREE

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
FIELD CONTROL SAMPLES							
301	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
302	<1.0	<1.0	<1.0	<1.0	<0.10	0.12	<0.05
323	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.05
324	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
330	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
331	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
332	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
342	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
344	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
LABORATORY DUPLICATE ANALYSES							
311D	14	<1.0	<1.0	<1.0	14	2.2	0.05
311DR	'4	<1.0	<1.0	<1.0	14	2.2	0.07
312D	23	<1.0	<1.0.	<1.0	0.15	<1.10	<0.05
312DR	22	<1.0	<1.0	<1.0	0.14	<0.10	<0.05
319D	27	<1.0	<1.0	<1.0	2.3	4.4	9.6
319DR	27	<1.0	<1.0	<1.0	2.3	4.4	9.0
336D	45	<1.0	3.9	<1.0	6.2	7.4	5.0
336DR	40	<1.0	2.3	<1.0	6.1	5.7	3.2
342D	18	<1.0	<1.0	<1.0	1.9	3.2	4.2
342RR	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
LABORATORY BLANKS							
311DB	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<0.05
B312DB	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	<0.05
319DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
336DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
342B	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

11DCE = 1,1-dichloroethene
11DCA = 1,1-dichloroethane
111TCA = 1,1,1-trichloroethane
PCE = tetrachloroethene
t12DCE = trans-1,2-dichloroet
c12DCE = cis-1,2-dichloroethe
TCE = trichloroethene

S = Shallow
D = Deep
* = Sample may contain higher concentrations of 111TCA, TCE and/or PCE.

DRAFT

TABLE 2-5
COMPARISON OF MOBILE VERSUS
FIXED-BASE SOIL-GAS RESULTS (ug/l)
NWIRP, BETHPAGE, NY

SAMPLE	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
106D	<1.0	<1.0	<1.0	<1.0	0.22	1.2	0.12
106D*	<1.0	<1.0	<1.0	<1.0	0.23	1.5	0.06
110S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.65
110S*	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.26
110D	3.6	<1.0	<1.0	<1.0	0.11	<0.10	0.78
110D*	2.7	<1.0	<1.0	<1.0	<0.10	<0.10	0.39
203S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
203S*	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
215D	6.4	<1.0	<1.0	<1.0	0.46	1.8	0.27
215D	6.4	<1.0	<1.0	<1.0	0.52	1.1	0.17
303D	3.7	<1.0	<1.0	<1.0	0.14	0.13	0.20
303D*	2.9	<1.0	<1.0	<1.0	0.17	<0.10	0.11
309D	12	<1.0	<1.0	<1.0	0.37	0.28	1.4
309D*	9.7	<1.0	<1.0	<1.0	0.38	0.14	0.61

11DCE = 1,1-dichloroethene
11DCA = 1,1-dichloroethane
111TCA = 1,1,1-trichloroethane
PCE = tetrachloroethene

t12DCE = trans-1,2-dichloroethene
c12DCE = cis-1,2-dichloroethene
TCE = trichloroethene

* = Fixed-Base Results

TABLE 2-6
TEMPORARY MONITORING WELL - RESULTS (ug/l)
NWIRP, BETHPAGE, NY

TEMPORARY WELL #	VC	11DCE	T12DCE	11DCA	C12DCE	111TCA	12DCA	28TCE	PCE
103	5U	5U	5U	5U	5U	5U	5U	28	5U
104	5U	5U	5U	5U	5U	94	5U	370	18
110DL	25U	25U	25	630	1600	5400	25U	950	5200
111	5U	5U	5U	5U	5U	5U	5U	5U	5U
112	5U	5U	5U	5U	5U	12	5U	10	5U
113	5U	5U	5U	5U	5U	8	5U	9	8
115	5U	5U	5U	43	150	180	5U	260	2000
119	5U	5U	5U	22	85	240	5U	280	1100
121DL	25U	25U	25U	110	540	1100	25U	1800	7700
123	5U	7	5U	22	48	200	5U	1900	780
202	5U	5U	5U	5U	5U	5U	5U	5U	5U
204	5U	5U	5U	5U	5U	5U	5U	5U	5U
205	5U	5U	5U	5U	5U	5U	5U	7	5U
209	5U	5U	5U	5U	5U	5U	5U	9	5U
215	5U	5U	5U	5U	5U	5U	5U	8	5U
218	5U	5U	5U	5U	5U	5U	5U	9	5U
219	5U	5U	5U	5U	5U	5U	5U	5U	5U
225	5U	5U	5U	5U	5U	5U	5U	5U	5U
227	5U	5U	5U	5U	5U	5U	5U	5U	5U
229	5U	5U	5U	5U	5U	5U	5U	5U	5U
304	5U	5U	5U	5U	5U	5U	5U	9	5U
307	5U	5U	5U	5U	5U	12	5U	12	5U
314	5U	5U	5U	5U	5U	5U	5U	8	5U
316	5U	5U	5U	5U	5U	5U	5U	12	5
318	5U	5U	5U	5U	5U	5U	5U	17	6
328	5U	5U	5U	5U	5U	7	5U	76	57
329	5U	5U	5U	5U	5U	5U	5U	5U	5U
334	5U	5U	5U	5U	5U	5U	5U	7	7
338	5U	5U	5U	22	10	10	5U	12	5U

U - Undetected
11DCE = 1,1-dichloroethene
11DCA = 1,1-dichloroethane
111TCA = 1,1,1-trichloroethane
PCE = tetrachloroethene
t12DCE = trans-1,2-dichloroethene
c12DCE = cis-1,2-dichloroethene
TCE = trichloroethene

135

drilled with a Mobil B-57 and a CME 75 drilling rig. Hollow stem augers were used to advance the borings through the overburden with a minimum borehole diameter of 10 inches. The shallow wells were constructed to be screened across the water table. The depth of each well was selected so that 8 feet of the 10-foot screen was below the water table and 2 feet was above the water table.

To determine the screened interval for the intermediate and deep monitoring wells, a pilot hole was drilled at each well cluster with 6-inch OD hollow stem augers. Split-barrel samples were taken every 10 feet and put in glass jars. Headspace readings were taken with a portable photoionizer (Hnu) field instrument for each sample. A gamma ray logger was run in each pilot hole to identify the lithologies present at the non-sampled intervals. The screened interval for the intermediate and deep wells was determined based upon the results of the gamma ray log and the headspace readings. Complete boring logs for all wells are included in Appendix D.

The intermediate wells were drilled using a failing F-10 rig. Hollow stem augers were used to advance the borings through the overburden with a minimum borehole diameter of 10 inches.

The deep wells were also drilled using a Failing F-10 rig. The borings were drilled with the mud rotary technique to a depth of 20 feet above the top of the screened interval. At this depth, the mud was pumped out of the borehole and a reverse-circulation water rotary technique was used to advance the borehole through the interval to be screened to the total depth of the well. Samples were not collected during the drilling of the deep wells due to the drilling methods employed.

The monitoring wells were constructed with a 4-inch diameter, Schedule 40 PVC well casing and 010-slot PVC well screen. The well screens were 10 feet in length, capped at the bottom with a PVC end plug. The annular space between the PVC well screen and the borehole was backfilled with a clean quartz sand pack composed of Morie No. 1 sand to a height of 3-5 feet above the top of the screen. For the shallow wells, a bentonite seal with a minimum thickness of 2 feet was emplaced above the filter pack. For the intermediate and deep wells, a masonry sand seal of 2 to 4 feet thick was emplaced above the filter pack. A bentonite slurry of a minimum 3 foot thickness was emplaced above the masonry sand seal. The remainder of the annulus for all intermediate and deep wells and most shallow wells was backfilled with a bentonite/cement grout to a depth approximately 3 feet below ground elevation. Wells 24S, 27S, and 28S were backfilled with a thick bentonite grout.

All wells were developed a minimum of 48 hours after installation. As directed by the NYSDEC, an attempt was made to develop each well to a water turbidity level of less than 50 NTU. This was achieved at every well but one (HN-29S). In addition, the groundwater temperature, pH, and conductivity were monitored during development. The well development logs are included as Appendix E.

The shallow wells were developed with a submersible pump. These wells, with one exception, developed quickly and to a turbidity of less than 50 NTU after a maximum of approximately 500 gallons had been dumped. Well HN-29S is the exception. Despite repeated effort and the pumpage of over 1,000 gallons, the turbidity of this well remained above 200 NTU, the maximum amount the turbidity meter could read. The pH and temperature readings, however, indicated stable conditions had been reached. After consultation with the on-site NYSDEC representative, it was decided that further development was not needed.

The intermediate and deep wells were developed through air lifting. These wells, with one exception, developed quickly and to a turbidity of less than 50 NTU, Well HN-28I is the exception. This well required surge-blocking before it developed to a turbidity of less than 50 NTU. The amount of water developed from the wells was also controlled by the amount of water added to the borehole to control running sands during hollow-stem auguring and/or the amount of circulation drilling. In all cases, the amount of water removed during development greatly exceeded the amount introduced during well installation. In general, between 3,500 and 7,000 gallons of water was pumped from each well during development.

2.6 Monitoring Well Sampling

Sampling and analysis of groundwater was conducted to determine the current level and extent of contamination and to provide data for use in the risk assessment and the evaluation of remedial action alternatives for the Feasibility Study. The groundwater sampling was conducted from December 3 through December 11, 1991 and included 19 wells: 14 shallow and intermediate wells, 1 USGS well, and 4 process wells. The groundwater sampling for the three deep wells was conducted on February 11 and 12, 1992. Monitoring well locations are shown in Figure 2-7.

The groundwater sampling and analysis program and sampling procedures are described in section 4.3.3.5 of the Final Work Plan (August 1991) and Section 6 of the Quality Assurance Plan (August 1991).

Field measurements collected during sampling were pH, temperature, specific conductivity, and turbidity. These results are provided in Appendix B. Groundwater samples were submitted to a Naval Energy and Environmental Support Activity (NEESA) approved laboratory using CLP methods. All groundwater samples were analyzed for Target Compound List (TCL) volatile organics, TCL semivolatile organics, Target Analyte List (TAL) metals (total and dissolved), cyanide and hexavalent chromium. Sample log sheets for all wells are included in Appendix B.

In addition to the chemical analysis used for the nature and extent of contamination and risk assessment, select samples were also evaluated for engineering parameters. Three samples were selected from all of the monitoring wells based on the field screening data; one sample representing a relatively low level of contamination (HN25-I), one sample representing an intermediate level of contamination (HN27-I), and one sample representing a high level of contamination (HN29-S). These engineering parameters consisted of the following: pH, total dissolved solids (TDS), alkalinity, and hardness to evaluate the scaling potential of the groundwater; biological oxygen demand-5 day (BOD), total organic carbon (TOC), and total suspended solids (TSS) to evaluate other contamination in the groundwater and potential treatment requirements.

Quality control samples including field duplicates, trip blanks, and rinsate blanks were collected and analyzed for each sampling round as specified in Table 2-7.

The analytical results for groundwater sampling are discussed in Section 4.0 and are summarized in Appendix C.

2.7 Surface Water and Sediment Sampling and Analysis

The surface water and sediment sampling procedures are described in Section 4 of the Final Work Plan and Section 6.0 of the Quality Assurance Plan.

Two samples of surface water were collected at the site. One surface water sample was taken from the influent cooling water recharge basin to evaluate potential contamination in process generated wastewaters, and the other sample was collected during a precipitation event from the influent storm water discharge recharge basin to evaluate the potential transport of contamination into the basins via storm water discharge.

Surface water sampling was conducted on December 4, 1991 following a day (December 3) of steady rain. There were intermittent snow showers at the time the sample was collected. The samples were submitted to a NEESA approved laboratory using CLP methods. All surface water samples were analyzed for TCL volatile organics, TCL semivolatile organics, TAL metals (total and dissolved), cyanide and hexavalent chromium.

Four sediment samples were collected at the site. Three sediment samples were taken in one basin and the fourth sample was taken in the other basin that currently receives discharge. A third basin at the site was not sampled because it is not currently in use and the sediment has been stripped away. Sediment sampling was conducted on August 27, 1991, and on December 11, 1991. All sediment samples were analyzed for TCL volatile and semivolatile organics, TAL metals, and cyanide.

TABLE 2-7

NEESA LEVEL D REQUIREMENTS
NWIRP, BETHPAGE, NY

QA/QC TYPE	NEESA REQUIREMENT
Field Duplicate	One duplicate in 10 samples per sample matrix.
Rinsate Blank	One sample of the final rinse during decontamination of sampling equipment per day. Initially, samples from every other day are analyzed. If analytes pertinent to the project are found in the rinsate, the remaining samples are analyzed.
Field Blank	One sample of each source water used for decontamination of sampling equipment for each sampling event.
Trip Blank	One sample of analyte-free water per day, for each shipment of samples for volatile organic analysis.
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One sample in 20 samples per sample matrix.

Sampling point locations for surface water and sediment samples ar illustrated in Figure 2-8. The analytical results for surfac water and sediment sampling are discussed in Section 4.0 and ar summarized in Appendix C.

Quality control samples including field duplicates, trip blanks and rinsate blanks were collected and analyzed as specified in th Final Quality Assurance Plan and the Final Work Plan.

2.8 Water Level Measurements

Two complete rounds of groundwater-level measurements were taken o December 18, 1991 and January 24, 1992 from 30 wells throughout th study area to better define groundwater flow paths and horizonta and vertical gradients. It should be noted that groundwater leve measurements taken on December 18, 1991 exclude wells: HN-25D, HN-29D, and HN-08D which had not been drilled when the measurement were taken.

All groundwater level readings were conducted using calibrate electrical water level indicators (M-scopes), or a weighted tap measure coated with chalk if moisture on the side of the wel casing was affecting the M-scope. All measurements were measure from a marked point on the top of the PVC well riser pipe. On fou wells (GM-7S,7I,7D,13D), measurements were taken from the top of a surface casing which was on top of the well. Geraghty and Mille has provided the necessary information to convert the readings t the top of PVC. All measurements were recorded to the nearest 0.01 foot. Measurements for each water level round were conducted within a 24-hour period of consistent weather conditions t minimize precipitation/atmospheric effects on groundwater levels.

Water-level data is presented in Table 2-8. Groundwater contour maps developed using these measurements are presented in Section 3.0.

2.9 Surveying

Between December 19, 1991 and January 29,1992, horizontal locations and vertical elevations were surveyed at 17 newly installed monitoring wells; a previously installed USGS well, 29 surface soil locations, and 73 soil gas locations.

Surveying for each well included the elevation of the ground surface adjacent to the well, and the top of the PVC riser. Surveying for all other locations were taken at the spot of the sample.

145

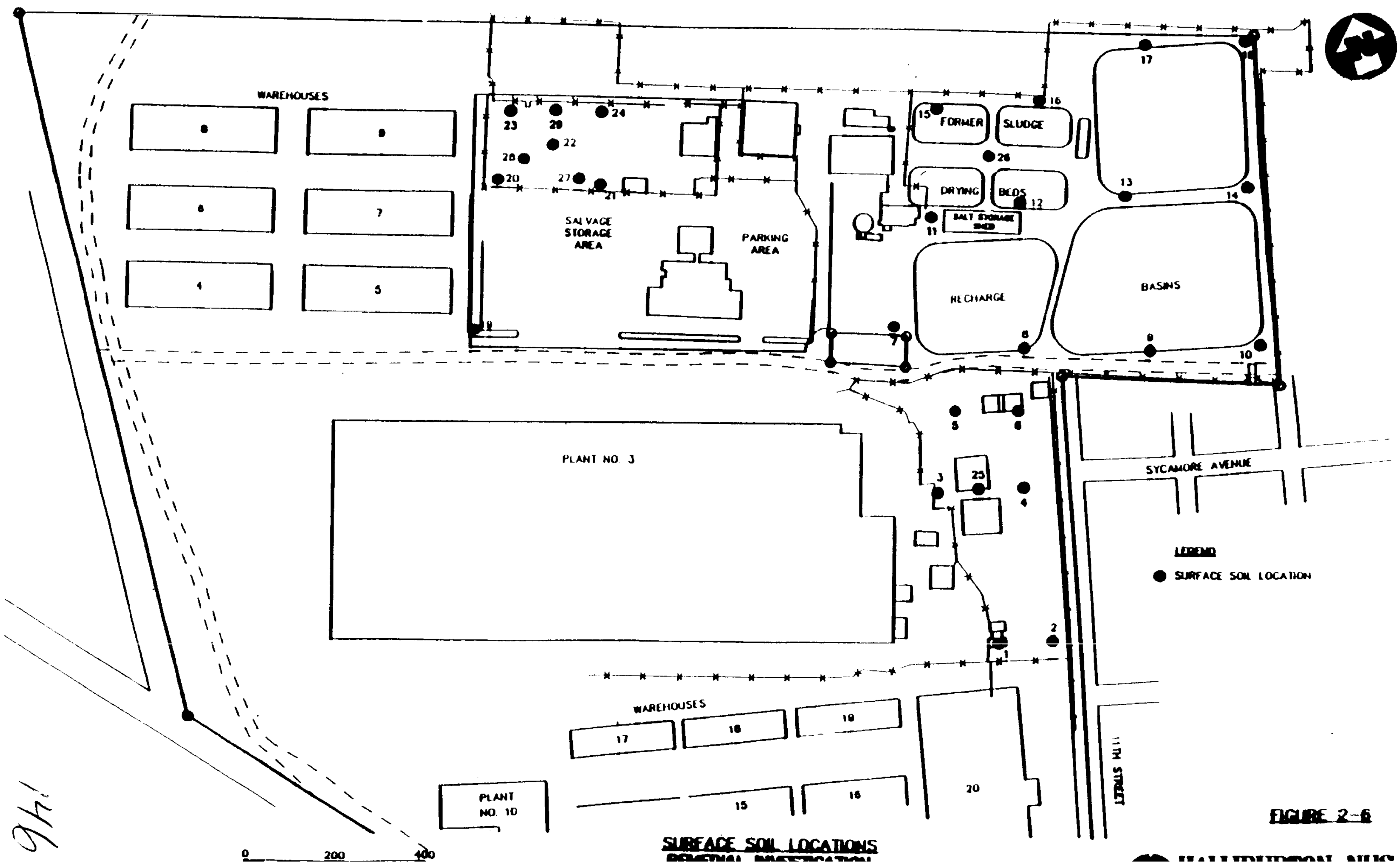
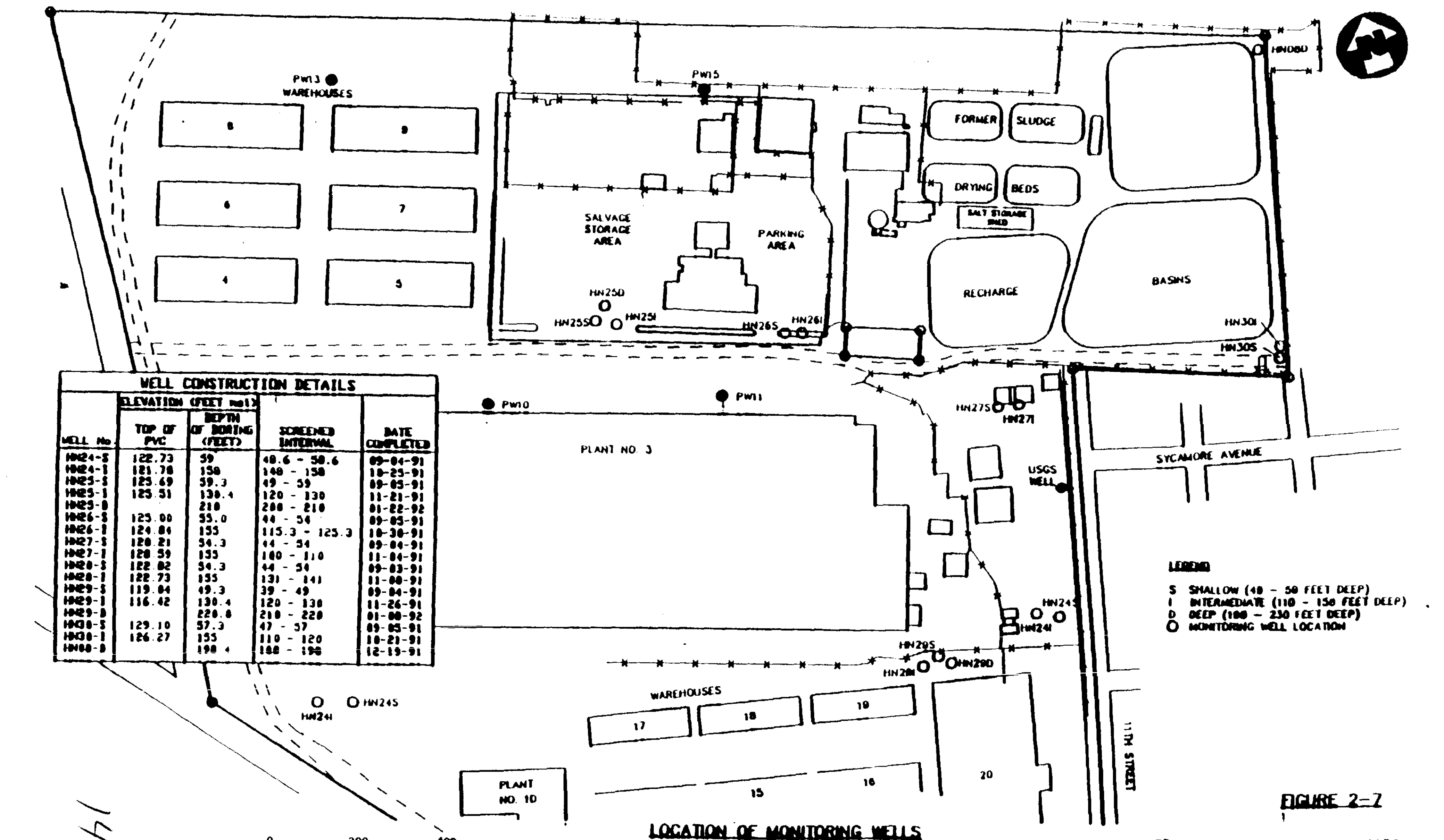


FIGURE 2-6

SURFACE SOIL LOCATIONS



WELL CONSTRUCTION DETAILS

WELL No.	ELEVATION (FEET msl) TOP OF PVC	DEPTH OF BORING (FEET)	SCREENED INTERVAL	DATE COMPLETED
HN24-S	122.73	59	40.6 - 50.6	09-04-91
HN24-I	121.70	150	140 - 150	10-25-91
HN25-S	125.69	59.3	49 - 59	09-05-91
HN25-I	125.51	130.4	120 - 130	11-21-91
HN25-D		210	200 - 210	01-22-92
HN26-S	125.00	55.0	44 - 54	09-05-91
HN26-I	124.04	155	115.3 - 125.3	10-30-91
HN27-S	120.21	54.3	44 - 54	09-04-91
HN27-I	120.59	155	100 - 110	11-04-91
HN28-S	122.02	54.3	44 - 54	09-03-91
HN28-I	122.73	155	131 - 141	11-08-91
HN29-S	119.04	49.3	39 - 49	09-04-91
HN29-I	116.42	130.4	120 - 130	11-26-91
HN29-D		220.8	210 - 220	01-08-92
HN30-S	129.10	57.3	47 - 57	09-05-91
HN30-I	126.27	155	110 - 120	10-21-91
HN08-D		190.4	180 - 190	12-19-91

FIGURE 2-7

LOCATION OF MONITORING WELLS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

147

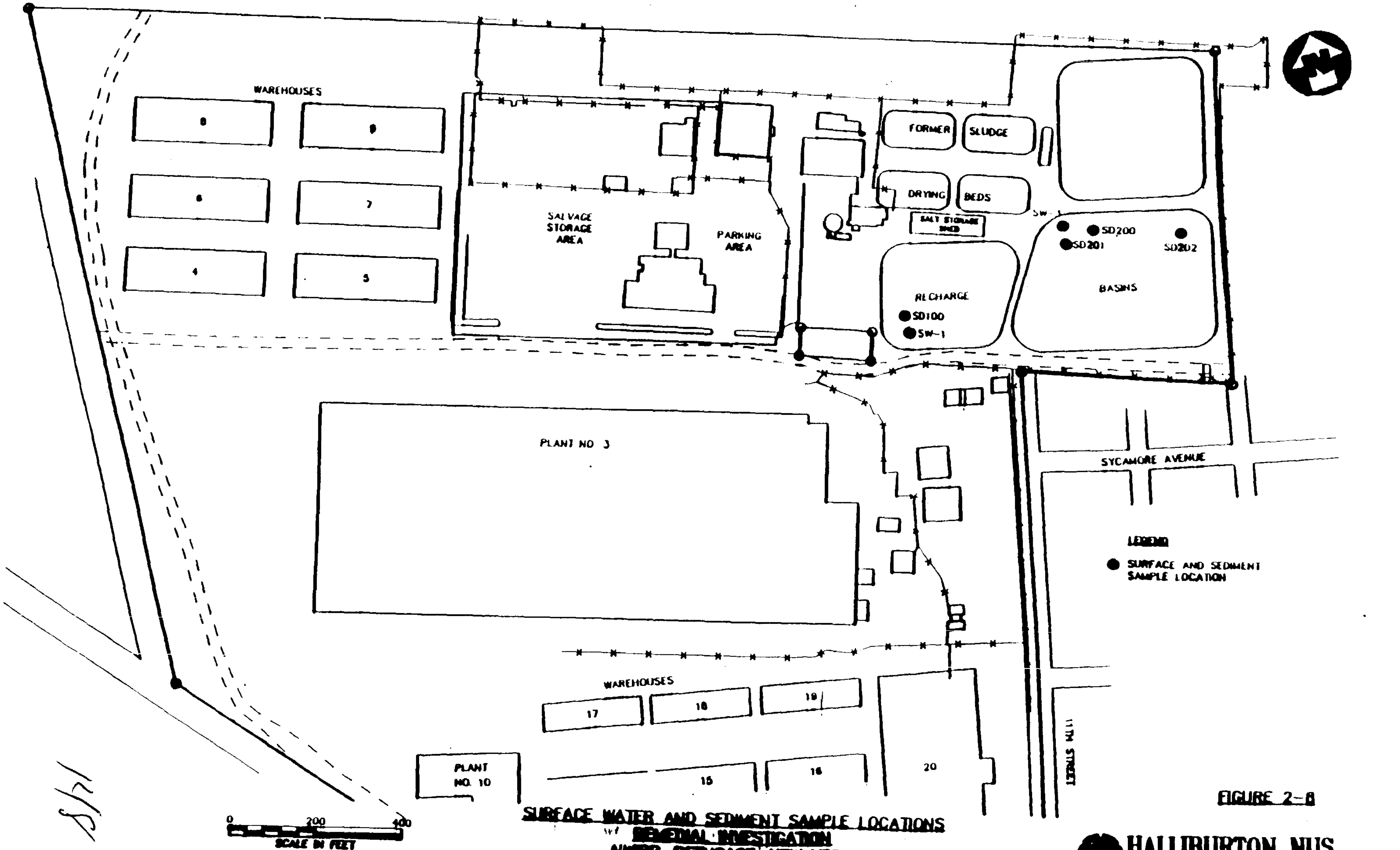


FIGURE 2-8

SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

TABLE 2-8
GROUNDWATER ELEVATIONS
NWIRP, BETHPAGE, NY

WELL #	TOP OF PVC (FEET MSL)	DECEMBER 18, 1991 DEPTH TO WATER (FEET)	DECEMBER 18, 1991 WATER ELEVATION (FEET MSL)	January 24, 1992 DEPTH TO WATER (FEET)	January 24, 1992 WATER ELEVATION (FEET MSL)
HN24-S	122.73	49.74	72.99	50.38	72.35
HN24-I	121.78	49.16	72.62	50.05	71.73
HN25-S	125.69	51.85	73.84	52.61	73.08
HN25-I	125.51	51.68	73.83	52.49	73.02
HN25-D		NA	NA	53.81	
HN26-S	125.00	49.62	75.38	50.49	74.51
HN26-I	124.84	49.98	74.86	50.60	74.24
HN27-S	128.21	52.83	75.38	53.57	74.64
HN27-I	128.59	53.71	74.88	54.50	74.09
HN28-S	122.82	49.24	73.58	50.17	72.65
HN28-I	122.73	49.87	72.86	50.82	71.91
HN29-S	119.04	45.28	73.76	46.28	72.76
HN29-I	116.42	43.59	73.83	44.45	71.97
HN29-D		NA	NA	44.99	
HN30-S	129.10	54.54	74.56	55.05	74.05
HN30-I	126.27	52.30	73.97	51.46	74.81
USGS	120.84	48.40	72.44	49.27	71.57
GM-6S	134.30	59.76	74.54	60.42	73.88
GM-6I	124.72	55.22	69.50	56.03	68.69
GM-7S	127.51	54.06	73.45	54.99	72.52
GM-7I	127.44	54.44	73.00	55.34	72.10
GM-7D	127.64	55.49	72.15	56.63	71.01
GM-8S	127.19	52.05	75.14	52.89	74.30
GM-8I	127.09	52.45	74.64	53.15	73.94
HN-8D		NA	NA	54.50	
GM-12S	120.55	48.10	72.45	48.85	71.70
GM-12I	120.51	48.35	72.16	49.18	71.33
GM-13S	115.88	43.21	72.67	44.70	71.18
GM-13I	115.75	43.85	71.90	44.57	71.18
GM-13D	113.97	45.02	68.95	45.96	68.01

NA = Not measured (Wells were not yet installed)

149

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of environmental contamination at the Bethpage NWIRP site is discussed in this section. The unvalidated analytical data generated during the 1991 Remedial Investigation provide the basis for this discussion. Methylene chloride, acetone and 2-butanone, which are common laboratory contaminants were detected in blanks associated with this case, were not considered in this analysis. Data validation may result in deletion or change to the results discussed here in Sections 4.0, 5.0, and 6.0. The complete analytical data base to date is included as Appendix C.

The remainder of this section is structured according to the types of investigative activities at the site. Section 4.1 presents the results of the soil-gas investigation. The results of field monitoring investigations are presented in Section 4.2. Sections 4.3, 4.4, and 4.5 include discussions of soil, recharge basin, and groundwater contamination, respectively.

4.1 Soil-Gas Investigation

Soil-gas sampling was done to help define the extent of volatile organic contamination and to assist in the selection of sampling locations. Trichloroethene (TCE) and Tetrachloroethene (PCE) were used as indicator chemicals. The concentrations referred to in this section are a sum of these two concentrations. These volatile organics were detected in soil gases at all three sites in both deep and shallow samples. Soil-gas sampling locations and results are presented in Figures 2-2 and 2-3.

Site 1 was found to have the highest detected soil-gas concentrations, with shallow soil-gas readings up to 724 ug/l around the former drum marshaling areas. The deep soil-gas results were similarly high with 148.7 to 713 ug/l observed from the former drum marshaling area to the southeastern portion of the site. The highest-concentration area corresponds to the most notable of trichloroethene (up to 200 ug/kg) and tetrachloroethene (up to 4800 ug/kg) concentrations detected in subsurface soil (see Section 4.3.2).

For Site 2, there appeared to be a source in the approximate center of the site, where readings of 11.22 ug/l and 10 ug/l were obtained in the shallow soil-gas samples, with lesser concentrations (e.g., 3.05 ug/l, 0.79 ug/l) closer to the edges of Site 2, and non-detects of volatile organics at the far edges. The highest-concentration area in Site 2 corresponds to the highest-concentration trichloroethene (up to 32 ug/kg at location 215, three-foot depth) detected in Site 2 (see Section 4.3.2). Similar, but lower concentrations were detected in the deep soil-gas results.

150

The pattern of soil-gas readings in Site 3 is not as clear as in the other two sites. Soil-gas readings ranged from non-detects (especially in the southeast corner) to very low detections of less than 1 ug/l, especially at the northern edge of the site to 92 ug/ in the southwestern, almost central, part of the site).

Very low readings (less than 1 ug/l) and non-detects were reported at the southwestern edge of Site 1, the border between Sites 1 and 2, all edges of Site 2, and the northern border of Site 3.

4.2 Field Monitoring Data

4.2.1 Temporary Monitoring Wells

As described in Section 2.3, temporary monitoring wells were installed based on the soil-gas survey results. These wells were screened in the shallow overburden aquifer.

The most former significant groundwater contamination found in temporary monitoring wells occurred at Site 1. Samples from wells located in the vicinity of the drum marshaling area and southwest of this area contained chlorinated ethanes and chlorinated ethenes at concentrations up to several hundred ug/l. In Site 2 concentrations of TCE ranging from 7 to 9 ug/l were detected; no TCE was detected at the northern or eastern edges of Site 2. At Site 3, chlorinated ethenes and ethanes, especially TCE, were detected, with higher concentrations (tens of ug/l) being reported in the western half of the site.

The pattern of groundwater contamination generally corresponds to the pattern of soil contamination observed from soil-gas and subsurface soil sampling (e.g., higher concentrations of organic compounds in Site 1, especially near the drum marshaling areas).

Groundwater is discussed in further detail in Section 4.5.

4.3 Soil

4.3.1 Surface Soil

A total of 29 surface soil samples were obtained at the three sites. Sampling locations were selected based on historical information regarding site chemical handling and disposal activities and as a result of the soil-gas survey. Surface soil samples were collected at points on a relatively uniform 300-foot by 300-foot grid and at field-determined opportune locations. Sample locations are displayed on Figure 2-6. The analytical results for the surface soil samples are summarized in Tables 4- and 4-2. In general, trace to low levels of VOCs were detected in surface soil samples. The highest reported concentrations of these compounds occurred in a sample from the western part of site 1 (PC up to 80 ug/kg, TCE up to 17 ug/kg). The distribution of TCE an

157

TABLE 4-1

OCCURRENCE AND DISTRIBUTION OF SURFACE SOIL CONTAMINANTS - ORGANIC (ug/kg))
NWIRP, BETHPAGE, NY

COMPOUND	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED				MAXIMUM POSITIVE DETECTION			REPRESENTATIVE CONCENTRATION*		
	CRQL	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3
Trichloroethene	5	4/7	1/13	0/9	17	2.25	-	10.3	2.25	-
Tetrachloroethene	5	2/7	0/13	0/9	80	-	-	41.7	-	-
Chloroform	5	0/7	2/13	3/9	-	1	2	-	2.0	2.0
Toluene	5	0/7	6/13	4/9	-	4.5	20	-	3.2	9.0
4-Methylphenol	330	0/7	1/13	0/9	-	75	-	-	75	-
Bis(2-chloroethyl)ether	330	0/7	0/13	1/9	-	-	360	-	-	360
4,4'-DDE	0.1	1/2	0/1	0/3	270	-	-	270	-	-
4,4'-DDT	0.1	1/2	0/1	0/3	170	-	-	170	-	-
gamma-Chlordane	0.5	1/2	0/1	0/3	240	-	-	240	-	-
Aroclor 1248	0.5	2/2	1/1	3/3	7900	1900	830	7900	1900	830
Aroclor 1254	1.0	0/2	0/1	1/3	-	-	530	-	-	530
Bis(2-ethylhexyl)phthalate	330	5/7	6/13	6/9	200	300	2400	179	188	1234
Butylbenzylphthalate	330	3/7	3/13	4/9	180	890	660	180	354	508
Di-n-butylphthalate	330	0/7	0/13	2/9	-	-	340	-	-	340
Dimethylphthalate	330	0/7	0/13	1/9	-	-	190	-	-	190
2-Methylnaphthalene	330	2/7	1/13	1/9	160	107	54	160	107	54
Naphthalene	330	1/7	1/13	0/9	53	210	-	53	186	-
Acenaphthylene	330	0/7	0/13	1/9	-	-	150	-	-	150
Acenaphthene	330	3/7	2/13	2/9	53	610	160	53	278	160
Dibenzofuran	330	0/7	1/13	0/9	-	330	-	-	215	-
Phenanthrene	330	7/7	10/13	7/9	700	3700	1090	554	1041	697
Anthracene	330	3/7	2/13	4/9	66	760	610	66	314	446
Fluoranthene	330	7/7	12/13	9/9	1100	3500	1800	837	1091	1151
Pyrene	330	7/7	12/13	9/9	950	2500	2500	793	815	1545
Benz[a]anthracene	330	7/7	7/13	5/9	550	1200	880	439	446	636
Chrysene	330	7/7	8/13	5/9	580	1100	1060	473	433	739
Benzo[b]fluoranthene	330	7/7	8/13	5/9	680	920	1200	575	411	716
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	620	1200	1400	477	454	864

TABLE 4-1
PAGE TWO

COMPOUND	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED				MAXIMUM POSITIVE DETECTION			REPRESENTATIVE CONCENTRATION*		
	CRQL	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3
Benzo[a]pyrene	330	7/7	7/13	5/9	620	1200	1300	502	463	784
Indeno[1,2,3-c,d]pyrene	330	7/7	5/13	5/9	430	690	920	349	313	580
Dibenz[a,h]anthracene	330	2/7	1/13	0/9	150	310	-	150	210	-
Benzo[g,h,i]perylene	330	7/7	4/13	6/9	420	630	980	350	305	636
Fluorene	330	2/7	1/13	2/9	44	560	180	44	271	180
PCBs (TICs)		7/7	7/13	1/9	666000	11680	2420	-	-	-

* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected.
TIC = Tentatively Identified Compound.
PCB = Polychlorinated Biphenyl.
CRQL = Contract Required Quantitation Limit.

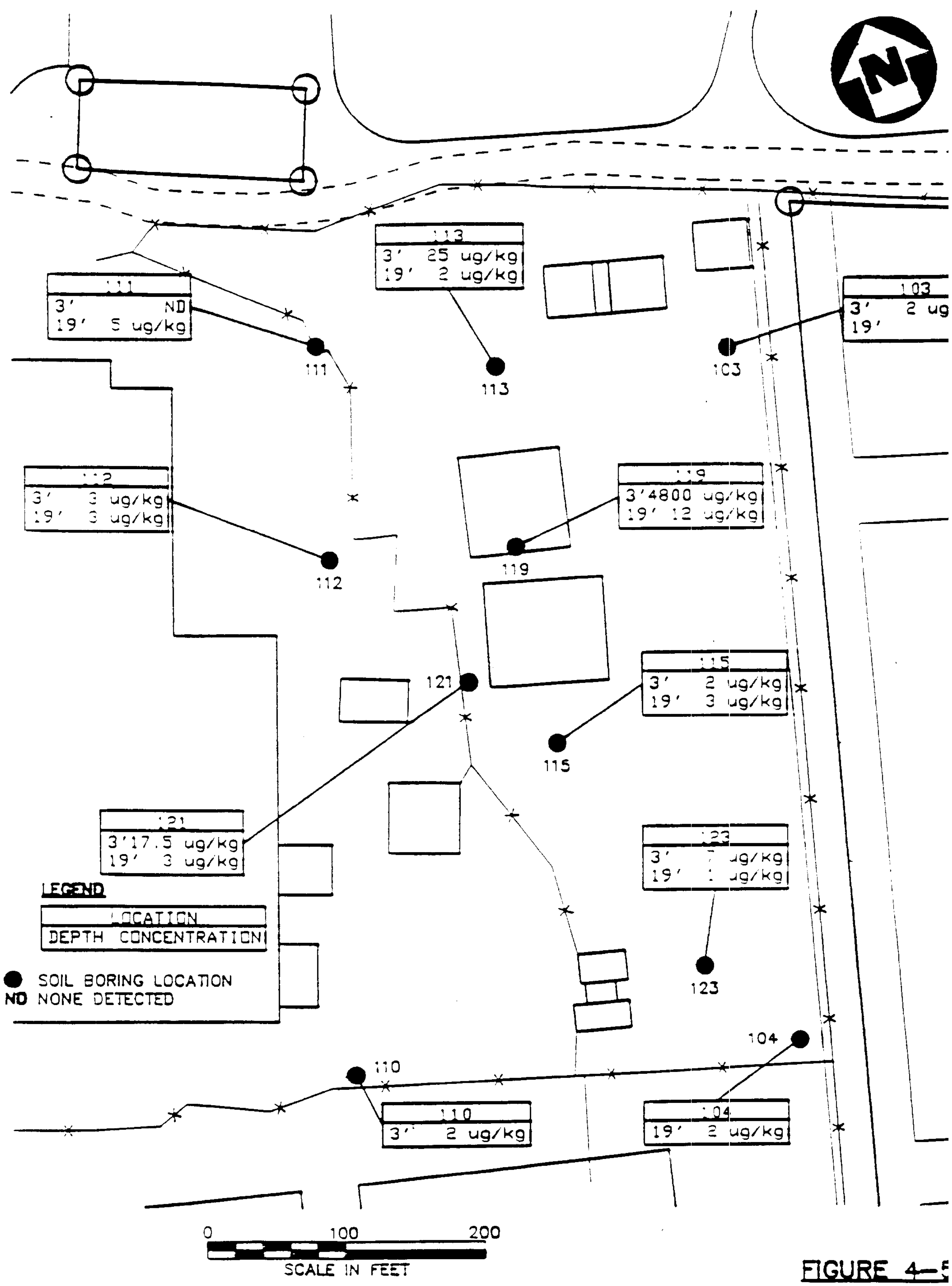


FIGURE 4-5

SITE 1 - SUBSURFACE SOIL RESULTS - PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

154

HALLIBURTON N
Environmental Corpora

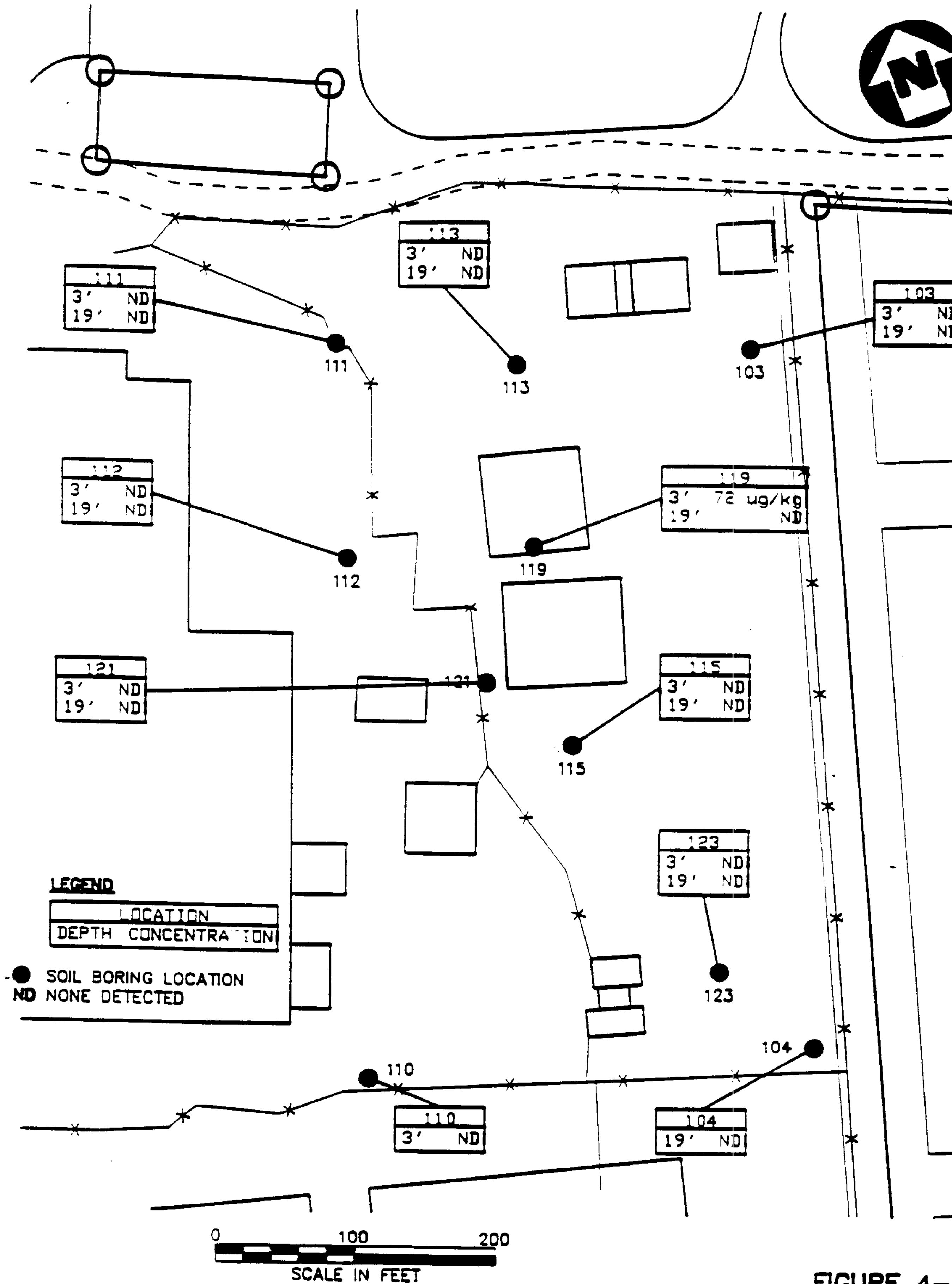


FIGURE 4-

155

SITE 1 – SUBSURFACE SOIL RESULTS – 1,1,1-TCA

REMEDIAL INVESTIGATION

NWIRP, BETHPAGE, NY

HALLIBURTON N

Environmental Corpora

PCE, is illustrated in Figures 4-1, 4-2, and 4-3. Another primary site contaminant, 1,1,1-Trichloroethane (1,1,1-TCA) was not detected in surface soils.

Low to moderate concentrations of phthalate esters (under 3,500 ug/kg) and Polynuclear aromatic hydrocarbons (PAHs) (under 20,000 ug/kg) were also detected throughout the site; no well-defined pattern of contamination by PAHs and phthalates is evident.

Polychlorinated biphenyls (PCBs) such as Aroclor 1248 and Aroclor 1254 were identified in surface soil from all three sites. PCB were detected in the northern and western portions of Site 3, all areas of Site 1, and most areas of Site 2, especially the southern and western portions. Concentrations of PCBs ranged from 44 to 7900 ug/kg, with the highest concentration occurring in the southern portion of Site 1.

Pesticides were detected in one surface sample from the southern part of Site 1. They included DDT and DDE (170 ug/kg and 270 ug/kg, respectively) and gamma-chlordane (240 ug/kg). These compounds were not detected at any other sample location. The herbicide prometon was identified as a TIC (tentatively identified compound) in one sample at Site 3.

For comparative purposes, concentrations of organic compounds in background (subsurface) soil sample are shown in Table 4-3. It can be seen that PAHs, which are common environmental contaminants, were detected up to approximately 7,000 ug/kg in background soil.

Inorganic elements detected at the activity are displayed in Table 4-2. Almost all metals were detected above levels observed in background (subsurface) soil. It can be seen that the highest concentrations of metals were generally detected in Site 3. Especially notable were lead, chromium, and arsenic concentrations (up to 625 mg/kg, 637 mg/kg, and 56.8 mg/kg, respectively). Mercury and silver are examples of metals with scattered, inconsistent positive detections. These metals were detected at the highest concentrations at Site 1. Cyanide was detected at low levels (up to 5.36 mg/kg) in one sample from each of the three sites. Substances associated particularly with plating detected at the sites are cadmium, nickel, zinc, silver, cyanide, copper, and chromium (Sittig, 1985). The significance of elements with inconsistent and low-frequency detections, such as antimony and selenium, is questionable.

At Site 3, the highest-concentration samples were SS-28 and SS-22 which were located near Plant No. 3 and warehouses in the northwestern part of Site 3. At Site 1, the highest-concentration sample was SS-6, which was located in the northeastern corner of Site 1. In Site 2, the highest-concentration samples were SS-1 and SS-16, which were located in the northwestern part of Site 2 It is apparent that the patterns of distribution of organic and

TABLE 4-2

OCCURRENCE AND DISTRIBUTION OF SURFACE SOIL CONTAMINANTS - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

ELEMENT	NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED				CONCENTRATION RANGE			REPRESENTATIVE CONCENTRATION*		
	CRDL	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3
Aluminum	40	6/7	13/13	9/9	3370-10800	1790-19500	8260-28000	8468	9627	19640
Antimony	12	0/7	0/13	3/9	-	-	ND-6.05	-	-	3.4
Arsenic	2	6/7	13/13	9/9	3.4-55	0-10.45	1.1-56.8	33.1	5.4	24.5
Barium	40	6/7	13/13	9/9	10.8-59	4.6-51.6	22.2-107	46.6	26.0	76.2
Beryllium	1	0/7	1/13	8/9	-	ND-0.88	ND-1.5	-	0.48	1.1
Cadmium	1	4/7	1/13	7/9	ND-28.5	ND-7.5	ND-16	14.8	2.2	8.2
Chromium	2	6/7	13/13	8/9	18.8-61.1	4.2-419	ND-637	49.1	128	258
Cobalt	10	2/7	4/13	9/9	ND-5.3	ND-15.2	3.6-19.9	4.4	5.9	16.1
Copper	5	6/7	12/13	9/9	24.8-121	ND-98.4	17.2-400	79.3	50.1	216
Iron	20	6/7	13/13	9/9	7266-15873	4810-26600	11000-135000	14708	13007	66563
Lead	0.6	6/7	13/13	8/9	19.2-178	7.9-39.65	ND-625	118.4	32.2	352
Manganese	3	6/7	13/13	9/9	101-260	56.6-237	64.5-896	184	138	509
Mercury	0.10	3/7	2/13	7/9	ND-5.54	ND-0.22	ND-0.5	2.8	0.11	0.29
Nickel	8	6/7	10/13	5/9	6.5-19.2	ND-12.1	ND-655	16.1	8.5	255
Selenium	1	0/7	0/13	1/9	-	-	ND-1	-	-	1.0
Silver	2	5/7	8/13	4/9	ND-6.3	ND-2.5	ND-4.3	3.5	1.2	2.0
Thallium	2	0/7	0/13	0/9	-	-	-	-	-	-
Vanadium	10	6/7	13/13	9/9	13.7-39.3	7.3-87.7	20.5-150	30.4	32.2	89.9
Zinc	4	6/7	13/13	9/9	33.1-349	5.1-81.8	41.3-698	214	52.8	416
Cyanide	2	1/7	1/13	1/9	ND-5.36	ND-3.06	ND-4.2	3.2	1.5	2.3

* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected; CRDL = Contract Required Detection Limit.

TABLE 4-3

BACKGROUND SOIL CONTAMINANTS - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

CHEMICAL	CRQL	SB202	SB204	SB205	SB329
Trichloroethene	5		1		
1,1,2-Trichloroethane (TIC)			150	190	
Tetrachloroethene	5				4
Phenanthrene	330				1030
Fluoranthene	330				1060
Pyrene	330				1000
Benzo(b)fluoranthene	330				450
Benzo(k)fluoranthene	330				410
Benzo(a)pyrene	330				540
Indeno(1,2,3,-c,d)pyrene	330				340
Benzo(g,h,i)perylene	330				300
Benz(a)anthracene	330				510
Chrysene	330				510
Acenaphthene	330				270
Naphthalene	330				61
Dibenzofuran	330				68
Fluorene	330				160
Anthracene	330				230
PAH (TIC)					2190
Carbon disulfide	5				1

TIC = Tentatively identified compound.
PAH = Polynuclear aromatic hydrocarbon.
* = A blank indicates that the compound was not detected.
CRQL = Contract Required Quantitation Limit.

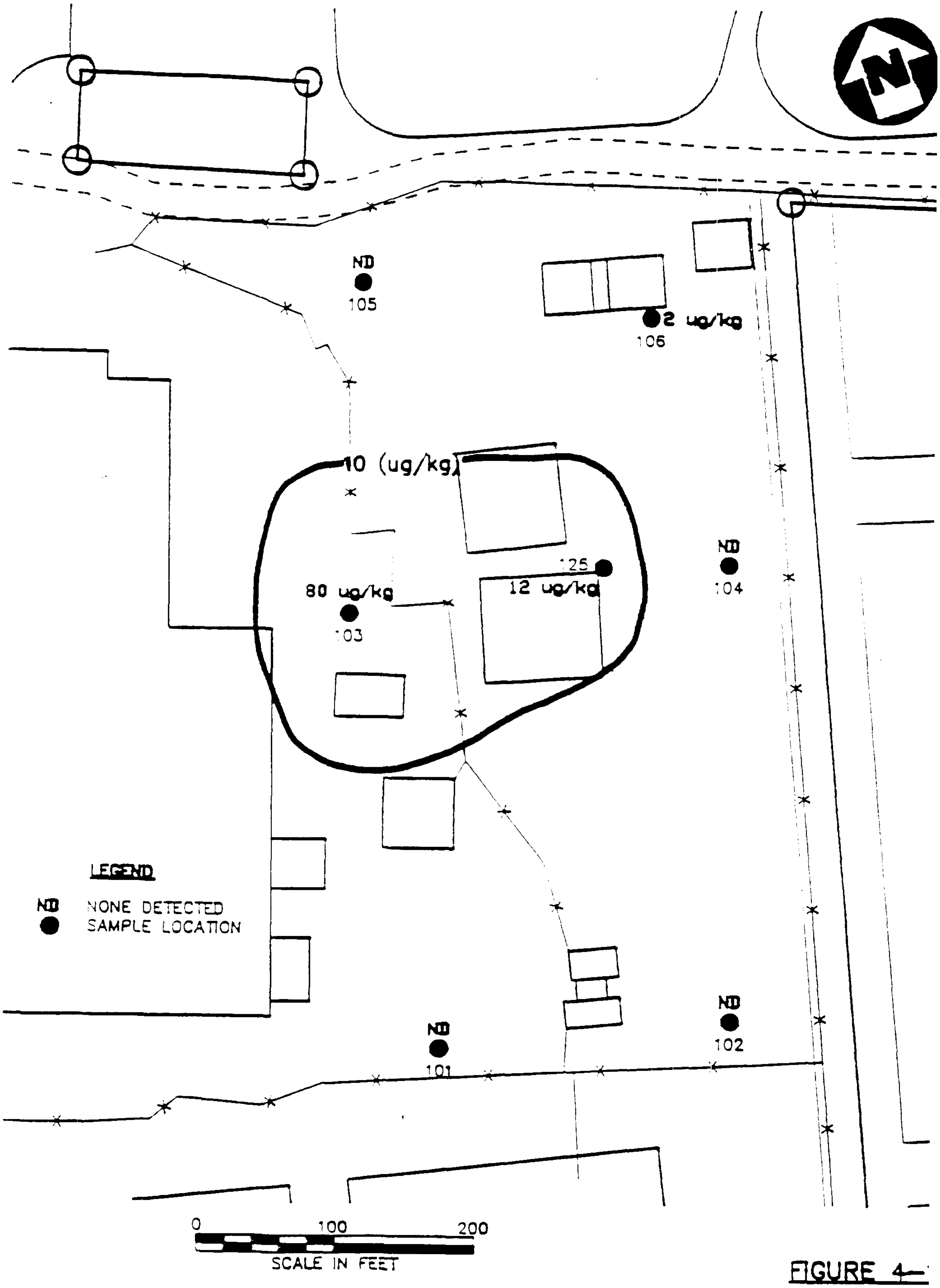


FIGURE 4-

15-9

SITE 1 – SURFACE SOIL RESULTS – PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON N
Environmental Corpora

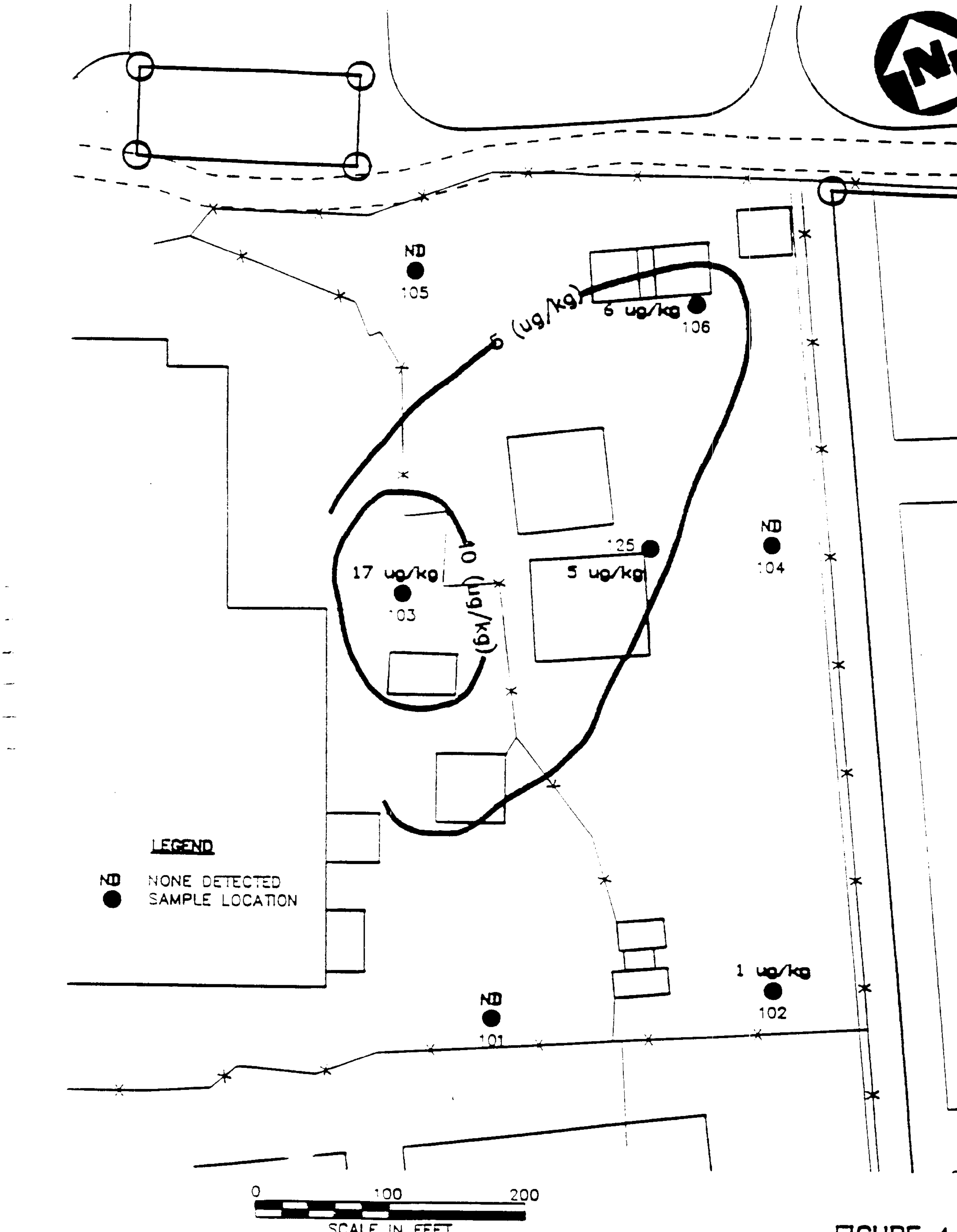


FIGURE 4-

160

SITE 1 – SURFACE SOIL RESULTS – TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON
Environmental Corpor

inorganic contaminants are quite different.

Table 4-4 presents the results of background (subsurface) soil inorganic analyses. All background samples were located north of the sites. The mean, standard deviation, and maximum results for each element are shown. Also shown is the 95% upper confidence limit ["B" which equals mean + (1.645) (standard deviation)]. The maximum and B values are then compared to on-site inorganic soil results in Table 4-5. These comparisons will be used in Section 6.0 in the selection of the chemicals of concern.

4.3.2 Subsurface Soil

General patterns of subsurface soil contamination were discussed in Section 4.1 as part of the soil-gas monitoring. Subsurface sample locations are presented in Figure 2-5. Table 4-6 presents the distribution of organic chemicals in subsurface soil. Subsurface soil samples were obtained at all three sites. Low-level Volatile Organic Chemicals (VOCs), especially TCE and PCE, were detected at all three sites at comparable concentrations. Figures 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, and 4-10 illustrate the subsurface distribution of detections of TCE, PCE, and 1,1,1-TCA. The concentrations of chlorinated ethenes exceed 10 ug/kg in only five samples. At Site 1, for the three-foot depths of SB-113, SB-119, and SB-121, PCE was detected at 25 ug/kg, up to 4800 ug/kg, and up to 26 ug/kg, respectively; it was also detected at 12 ug/kg at the nineteen-foot depth of SB-119. TCE at the three-foot depth of SB-119 was detected at 200 ug/kg. Sample SB-119 was located in former drum marshaling area no. 2. At Site 2, TCE was detected at the three-foot depth of SB-215 at 32 ug/kg. At Site 3, PCE was detected at the nineteen-foot depth of SB-304 at 55 ug/kg. In general, concentrations of compounds in samples obtained at nineteen feet were not significantly greater than concentrations at three feet. There appears to be overall trace-to-low-level chlorinated ethene contamination at the sites, with higher VOC concentrations in Site 1.

PCBs were tentatively identified at one location in Site 1 (121, 3-foot depth). PCBs were confidently and tentatively identified at several locations in Site 2 (206, 215, and 229, three-foot depth). The only confidently identified Aroclor was Aroclor 1248, which was detected up to 6800 ug/kg.

PAHs, which are common environmental contaminants, were confidently and tentatively identified in subsoil throughout Sites 2 and 3. Phthalates, which are plasticizers and are also common environmental contaminants as well as common blank contaminants, were detected at low concentrations at several locations at Site 2, at one location at Site 1, and at two locations at Site 3.

161

TABLE 4-4

BACKGROUND SUBSURFACE SOIL RESULTS - INORGANICS (mg/kg)
NWIRP, BETHPAGE, NY

ELEMENT	CRDL	SB202	SB204	SB205	SB329	MEAN	STD	B	MAX
Aluminum	40	6350	9370	2900	10100	7180	3269	12558	10100
Antimony	12	<5.1	<5.3	<6.2	<4.5	NC	NC	NC	<6.2
Arsenic	2	1.5	2.9	3	2.6	2.5	0.68	3.6	3
Barium	40	14.9	29.9	6.2	22.6	18.4	10.13	35.1	29.9
Beryllium	1	<0.8	<0.84	<0.98	<0.86	NC	NC	NC	<0.98
Cadmium	1	<0.99	<1.0	<1.2	<1.1	NC	NC	NC	<1.20
Calcium	1000	80.1	32*	37.35*	583	183	266	621	583
Chromium	2	9.2	9.3	4.4	12.7	8.9	3.4	14.5	12.7
Cobalt	10	4.8	6	2.8*	4.45*	4.5	1.3	6.7	6
Copper	5	5.1	4.2	4	4.2	4.38	0.49	5.2	5.1
Iron	20	11800	14600	8390	11400	11547	2530	15710	14600
Lead	0.6	3.2	10.4	11.5	7.8	9.2	3.7	14.3	11.5
Magnesium	1000	1030	1560	522	1080	1048	423	1743	1560
Manganese	3	97.3	110	134	167	127	30.5	177	167
Mercury	0.1	0.05*	0.055*	0.14	0.055*	0.075	0.04	0.15	0.14
Nickel	8	2.5*	5.3	3.1*	2.7*	3.4	1.28	5.5	5.3
Potassium	1000	478	644	503	353	494	119	690	644
Selenium	1	<1.0	<1.1	<1.3	<0.56	NC	NC	NC	<1.30
Silver	2	<0.25	<0.26	<0.31	<0.2	NC	NC	NC	<0.31
Sodium	100	188	198	206	190	195	8.2	209	206
Thallium	2	<0.67	<0.7	<0.82	<0.72	NC	NC	NC	<0.82
Vanadium	10	12.9	21.3	7.1	17.9	14.8	6.1	24.9	21.3
Zinc	4	14.8	18.9	10.6	20	16.1	4.26	23.0	20
Cyanide	2	<2.1	<2.2	<2.6	<2.25	NC	NC	NC	<2.60

MEAN = Arithmetic mean.
STD = Standard deviation, with n-1 samples.
MAX = Maximum reported background.
B = 95% Upper Confidence Limit (MEAN + (1.645) * (STD)).
NC = Not calculated.
CRDL = Contract Required Detection Limit

162

TABLE 4-5

COMPARISON OF BACKGROUND AND ON-SITE SOIL - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

ELEMENT	CRDL	BACKGROUND SUBSURFACE SOIL ($\bar{X}$)	BACKGROUND SUBSURFACE SOIL (MAX)	REPRESENTATIVE CONCENTRATION							
				SUBSOIL SITE 1	SUBSOIL SITE 2	SUBSOIL SITE 3	SURFACE SOIL SITE 1	SURFACE SOIL SITE 2	SURFACE SOIL SITE 3	SEDIMENT 8/28	SEDIMENT 12/12
Aluminum	40	12558	10100	6832	6767	6666	8468	9627	19640	1110	1340
Antimony	12	NC	<6.2	5.2	-	-	-	-	3.40	-	-
Arsenic	2	3.6	3	1244	5.9	3.0	33.1	5.4	24.5	2.8	1.6
Barium	40	35.1	29.9	17.6	17.6	19.0	46.6	26.0	76.2	5.3	6.3
Beryllium	1	NC	<0.98	-	-	-	-	0.48	1.1	-	-
Cadmium	1	NC	<1.2	2.0	1.0	-	14.8	2.2	8.2	-	0.41
Calcium	1000	621	583	293	1819	320	5492	3551	41986	165.5	176
Chromium	2	14.5	12.7	9.5	22.1	8.2	49.1	128	258	18	27.5
Cobalt	10	6.7	6	3.0	-	-	4.4	5.9	16.1	-	-
Copper	5	5.2	5.1	5.4	33.1	11.1	79.3	50.1	216	89.9	141
Iron	20	15710	14600	8400	10676	10480	14708	13007	66563	6480	4510
Lead	0.6	14.3	11.5	4.5	28.2	10.9	118.4	32.2	352	5.8	23.2
Magnesium	1000	1743	1560	1018	949	671	2682	2188	5927	156	239
Manganese	3	177	167	126	130	192	184	138	509	74.7	28.6
Mercury	0.1	0.15	0.14	0.07	0.18	0.15	2.8	0.11	0.29	-	0.18
Nickel	8	5.5	5.3	4.3	3.8	-	16.1	8.5	255	-	3.8
Potassium	1000	690	644	322	447	384	593	847	930	65.6	-
Selenium	1	NC	<1.3	-	-	-	-	-	1.0	-	-
Silver	2	NC	<0.31	-	1.3	-	3.5	1.2	2.0	0.3	0.96
Sodium	1000	209	206	184	209	208	498	777	1533	148.5	30.1
Thallium	2	NC	<0.82	-	-	-	-	-	-	-	-
Vanadium	10	24.9	21.3	11.8	15.3	13.0	30.4	32.2	89.9	10.4	65
Zinc	4	23.0	20	14.4	39.3	20.1	214	52.8	416	18.4	19.2
Cyanide	2	NC	<2.6	6.0	-	-	3.2	1.5	2.3	-	-

163

TABLE 4-6

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

COMPOUND	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED				MAXIMUM POSITIVE CONCENTRATION			REPRESENTATIVE CONCENTRATION*		
	CRQL	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3
Trichloroethene	5	2/18	3/9	3/15	200	32	9	36.5	13.8	3.9
Tetrachloroethene	5	16/18	4/9	11/15	4800	6	55	834	4.0	13.9
1,2-Dichloroethene	5	1/18	0/9	1/15	6	-	8	3.1	-	3.7
1,1,1-Trichloroethane	5	1/18	0/9	0/15	72	-	-	14.5	-	-
Toluene	5	0/18	0/9	2/15	-	-	3	-	-	2.7
4-Methyl-2-pentanone	10	1/18	0/9	0/15	1	-	-	1	-	-
Aroclor 1248	0.5	0/0	1/1	0/3	-	6800	-	-	6800	-
Bis(2-ethylhexyl)phthalate	330	0/9	3/9	1/8	-	62	140	-	62	140
Di-n-butylphthalate	330	2/9	3/9	0/9	16	40	-	16	40	-
Butylbenzylphthalate	330	1/9	0/12	1/8	97.5	-	41	97.5	-	41
Dibenzofuran	330	0/9	1/12	0/8	-	109	-	-	109	-
Naphthalene	330	0/9	1/12	0/8	-	86	-	-	86	-
Acenaphthene	330	0/9	1/12	0/8	-	270	-	-	213	-
Fluorene	330	0/9	1/12	0/8	-	180	-	-	180	-
Anthracene	330	0/9	1/12	0/8	-	220	-	-	196	-
Phenanthrene	330	0/9	5/9	0/8	-	1300	-	-	564	-
Fluoranthene	330	0/9	5/9	2/8	-	1900	57	-	805	57
Pyrene	330	0/9	5/9	2/8	-	1800	70	-	760	70
Benzo[b]fluoranthene	330	0/9	3/9	1/8	-	980	46	-	462	46
Benzo[k]fluoranthene	330	0/9	3/9	1/8	-	730	43	-	369	43
Benzo[a]pyrene	330	0/9	3/9	1/8	-	810	50	-	397	50
Indeno[1,2,3,-c,d]pyrene	330	0/9	2/9	0/8	-	62	-	-	62	-
Benzo[g,h,i]perylene	330	0/9	3/9	1/8	-	490	41	-	281	41
Benz[a]anthracene	330	0/9	2/9	0/8	-	740	-	-	379	-
Chrysene	330	0/9	2/9	1/8	-	910	43	-	444	43
TIC PCBs		1/9	3/9	0/8	185	6430	-	-	-	-
2-Methylnaphthalene	330	0/9	1/9	0/8	-	52	-	-	52	-

164

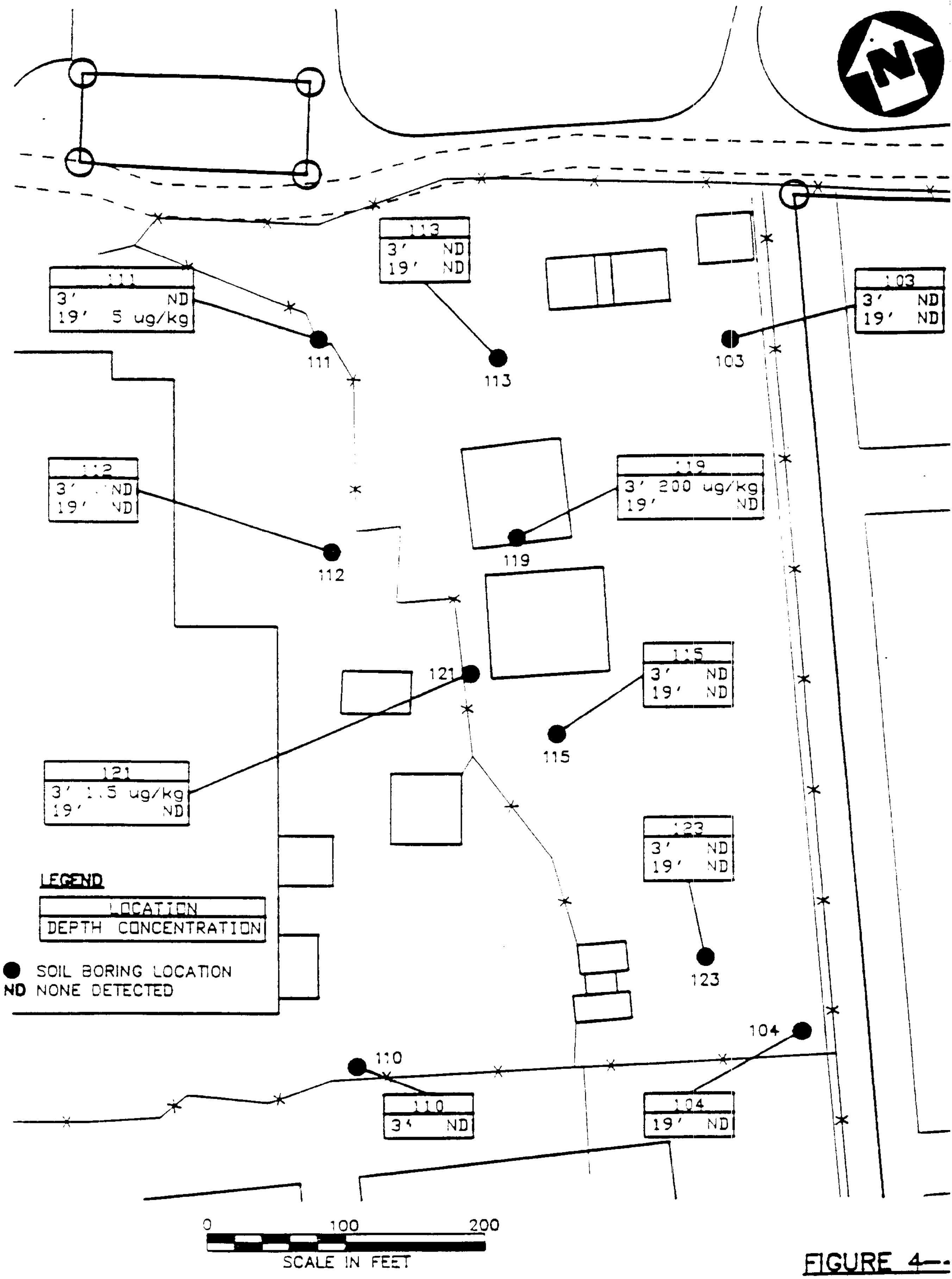


FIGURE 4--

165

SITE 1 – SUBSURFACE SOIL RESULTS – TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON N
Environmental Corpora

ACAD: 3281\...DWG 1/30/92 MB

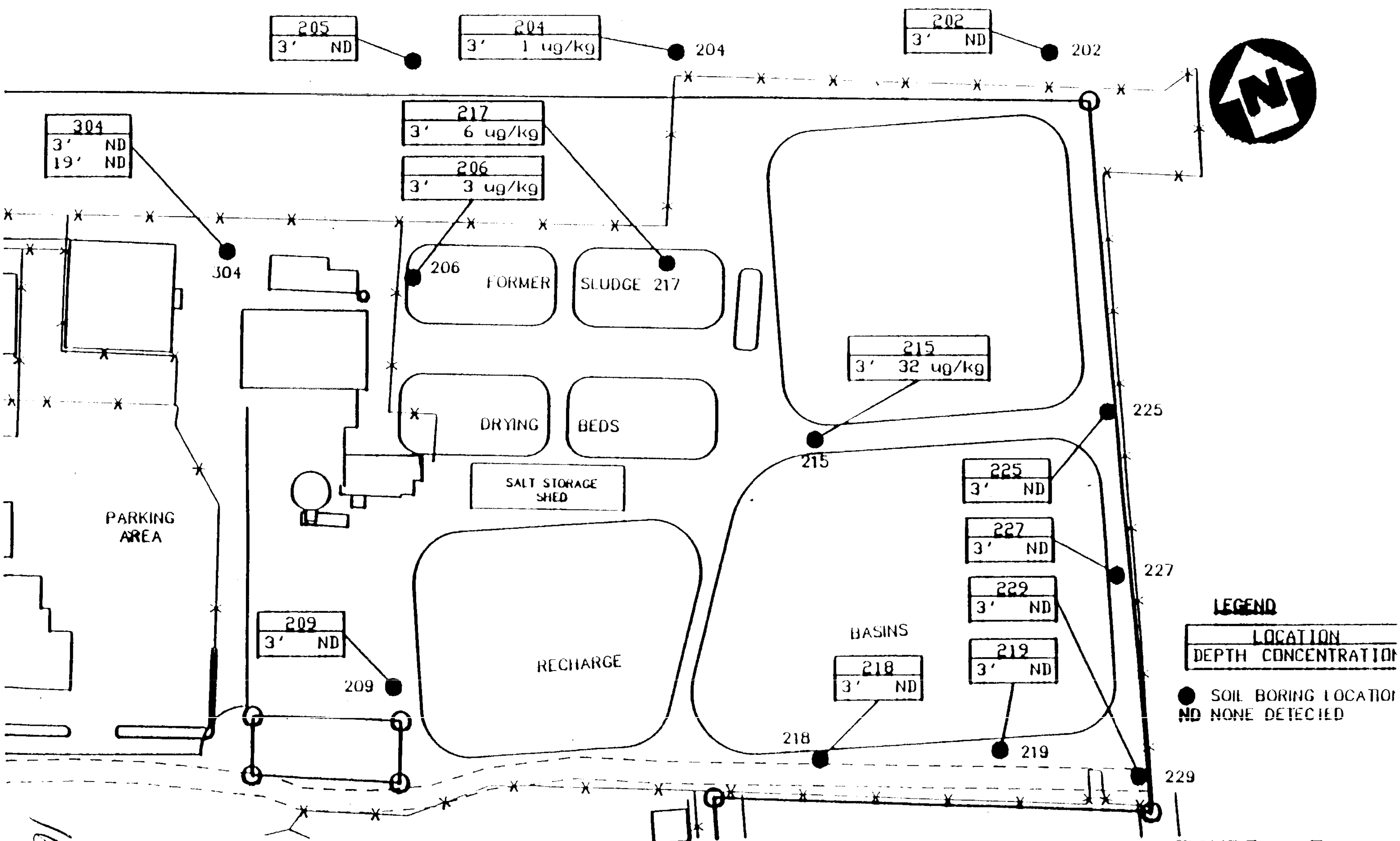


FIGURE 4-7

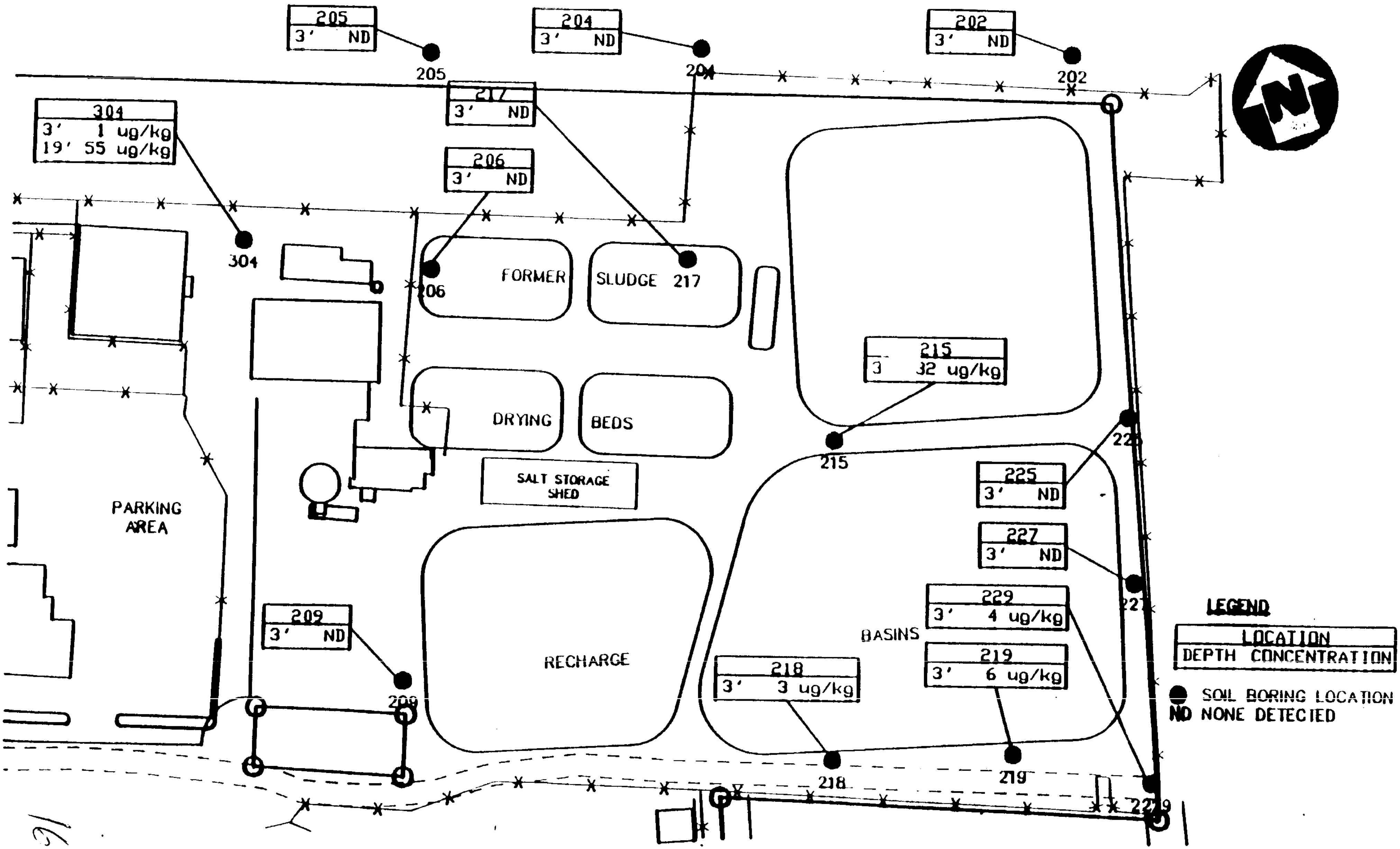
166

0 150 300

SITE 2 - SUBSURFACE SOIL RESULTS - TCE
REMEDIAL INVESTIGATION

HALLIBURTON NUS

ACAD: 3281\SITE2.DWG 1/30/92 MB



167

0 150 300

SITE 2 - SUBSURFACE SOIL RESULTS - PCE
REMEDIAL INVESTIGATION

FIGURE 4-8

HALLIBURTON NUS

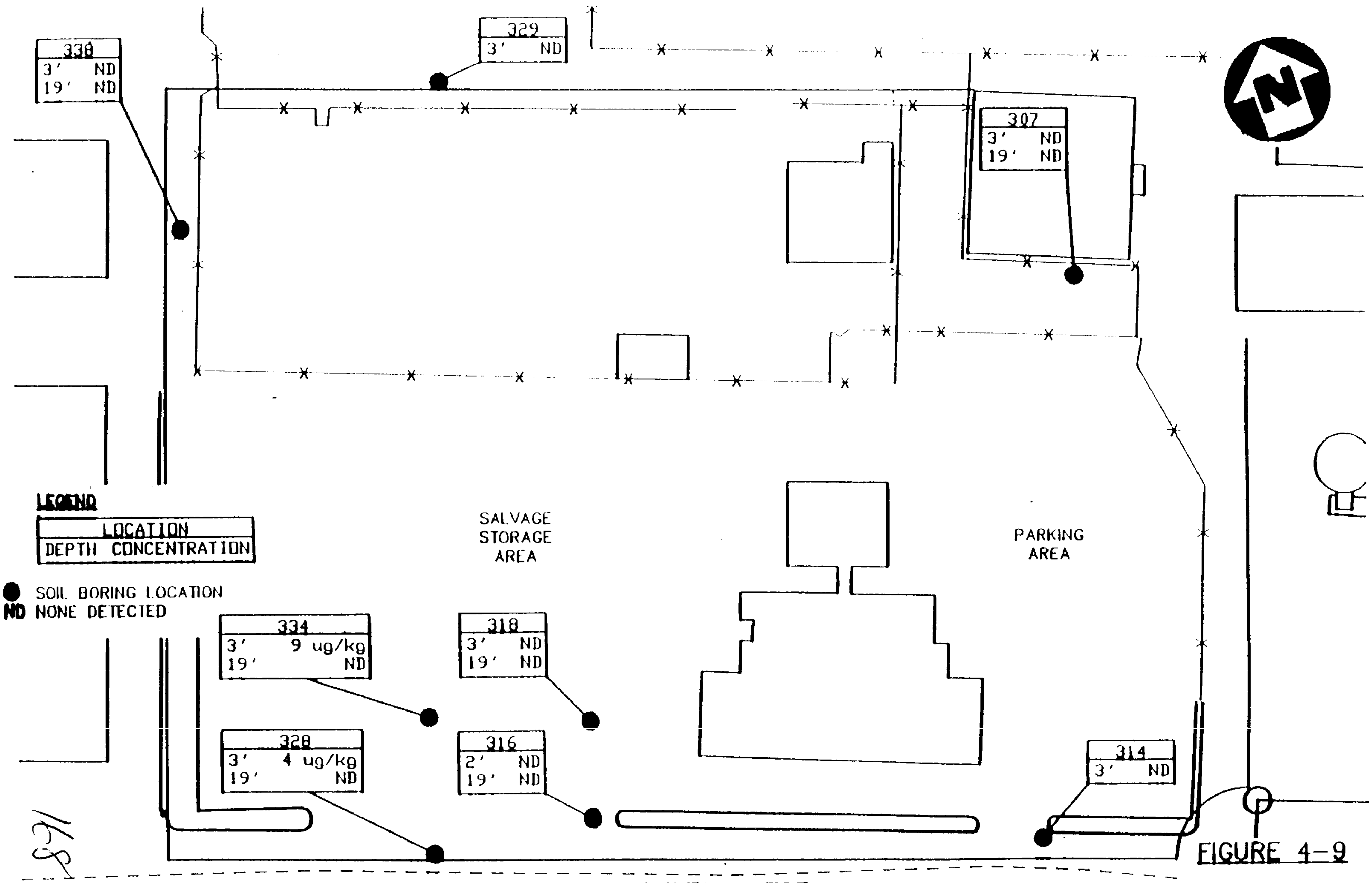
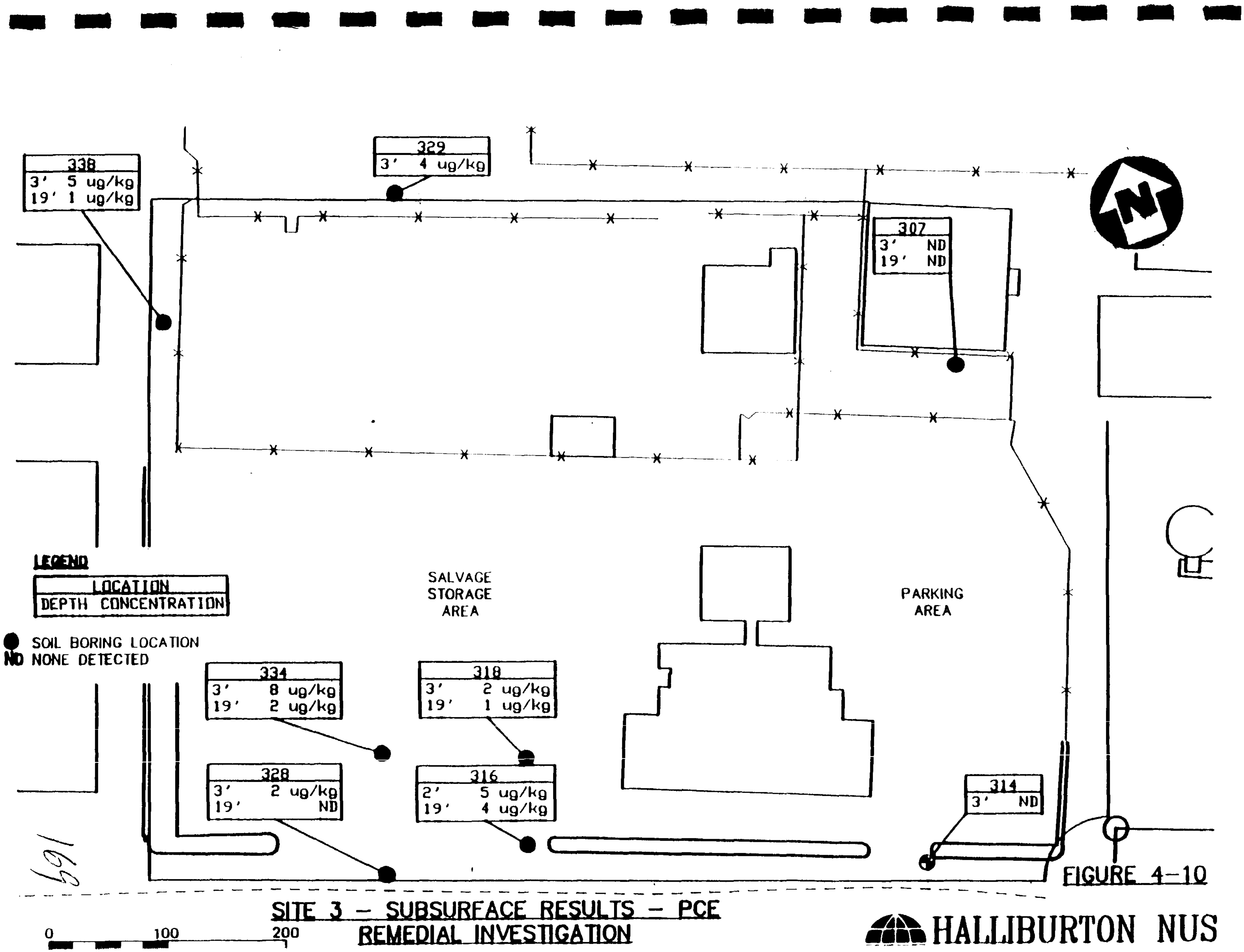


FIGURE 4-9

0 100 200

SITE 3 – SUBSURFACE RESULTS – TCE
REMEDIAL INVESTIGATION

HALLIBURTON NUS



169

FIGURE 4-10

SITE 3 - SUBSURFACE RESULTS - PCE
REMEDIAL INVESTIGATION

HALLIBURTON NUS

Chlorinated solvents were detected at trace levels in background soil samples (See Table 4-3). PAHs were also detected in background soil samples, up to approximately 7000 ug/kg.

Table 4-7 displays inorganic analytical results for subsurface soil. Site 3, which generally exhibited the greatest inorganic surface contamination, exhibited the lowest inorganic subsurface contamination. The reverse was true for Site 2. Concentrations of some metals (e.g., barium, iron) were consistent across all three sites. The following metals were detected at the highest concentrations in Site 2: chromium, copper, lead, mercury, silver, and zinc. These metals can be associated with plating (Sittig, 1985).

The highest-concentration sample in Site 1 was one of a field duplicate pair at SB-121; this was located roughly in the center of Site 1, southwest of the former drum marshaling areas. However, the high arsenic result and the high result for cyanide in SB-119 are notable. SB-119 is located at drum marshaling area No. 2. The highest-concentration samples in Site 2 were SB-229 and SB-217, with various high-concentration detections scattered throughout the site. SB-229 was located in the southwestern corner of Site 2, while SB-217 was located in the area of the former sludge drying beds. Sample SB-206, located near SB-217, also exhibited notable levels of several metals. The highest-concentration samples in Site 3 are SB-334 and SB-328, which were located in the southwestern part of Site 3.

4.4 <u>Recharge Basins</u>

Water and sediment samples were obtained from the recharge basins. Sample locations are displayed on Figure 2-6.

4.4.1 Recharge Basin Water

Recharge basin surface water results are presented in Tables 4-8 and 4-9. Table 4-8 displays organic contaminants detected in surface water.

Trace-to-low-level VOCs were identified in the recharge basins, along with a low-level phthalate ester. The most notable result is that of TCE at 35 ug/l. The distribution of TCE, PCE, and 1,1,1-TCA concentrations in surface water can be seen in Figure 4-11.

Table 4-9 displays inorganic elements detected in surface water. Both filtered and unfiltered samples were obtained.

It can be seen that the filtered and unfiltered sample results for the recharge basin water are very similar, with only iron displaying a significant reduction in the filtered result. None of the results in Table 4-9 exceed drinking water criteria (See Table 6-5 in Section 6.0).

TABLE 4-7

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED				CONCENTRATION RANGE			REPRESENTATIVE CONCENTRATION*		
	CRDL	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3
Aluminum	40	9/9	9/9	8/8	1010-11429	1600-7940	1530-10400	6832	6767	6666
Antimony	12	1/9	0/9	0/8	ND-9.8	-	-	5.2	-	-
Arsenic	2	8/9	7/9	6/8	ND-3380	ND-10.7	ND-4.6	1244	5.9	3.0
Barium	40	9/9	9/9	8/8	4.1-30.73	3.1-22	3.3-28.5	17.6	17.6	19.0
Beryllium	1	0/9	0/9	0/8	-	-	-	-	-	-
Cadmium	1	2/9	3/9	0/8	ND-4.5	ND-1.4	-	2.0	1.0	-
Chromium	2	9/9	9/9	8/8	2.7-10.94	2.5-40.15	2.4-9.9	9.5	22.7	8.2
Cobalt	10	1/9	0/9	0/8	ND-4.3	-	-	3.0	-	-
Copper	5	7/9	7/9	6/8	ND-7.9	ND-60.85	ND-15.8	5.4	33.1	11.1
Iron	20	9/9	9/9	8/8	2210-12913	5360-12300	4060-14300	8400	10676	10480
Lead	0.6	9/9	9/9	7/8	1-5.3	1-43.4	ND-19.7	4.5	28.2	10.9
Manganese	3	9/9	9/9	8/8	15.1-167	30.95-182	52.1-267	126	130	192
Mercury	0.1	1/9	4/9	2/8	ND-0.108	ND-0.32	ND-0.22	0.07	0.18	0.15
Nickel	8	2/9	1/9	0/8	ND-6.0	ND-5.8	-	4.3	3.8	-
Selenium	1	0/9	0/9	0/8	-	-	-	-	-	-
Silver	2	0/9	4/9	0/8	-	ND-2.65	-	-	1.3	-
Thallium	2	0/9	0/9	0/8	-	-	-	-	-	-
Vanadium	10	7/9	8/9	8/8	ND-17.9	ND-19.3	4.2-20.5	11.8	15.3	13.0
Zinc	4	9/9	9/9	8/8	7.9-19.4	5.2-74	5.9-28.8	14.4	39.3	20.1
Cyanide	2	2/9	0/9	0/8	ND-13.27	-	-	6.0	-	-

* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected; - = Not detected; CRDL = Contract Required Detection Limit.

TABLE 4-8

OCCURRENCE AND DISTRIBUTION OF
SURFACE WATER CONTAMINANTS - ORGANIC (ug/l)
NWIRP, BETHPAGE, NY

COMPOUND	CRQL	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION*
1,1-Dichloroethene	5	1/2	1
1,1,1-Trichloroethane	5	2/2	6
Trichloroethene	5	2/2	35
Tetrachloroethene	5	1/2	3
Bis (2-ethylhexyl) phthalate	10	2/3	2
PCE (TIC)		1/3	7
TCA (TIC)		1/3	5

* In a sample population of this size, the representative concentration equals the maximum positive concentration.

TIC = Tentatively identified compound.
PCE = Tetrachloroethene.
TCA = Trichloroethane.
CRQL = Contract Required Quantitation Limit.

TABLE 4-9

OCCURRENCE AND DISTRIBUTION
OF SURFACE WATER CONTAMINANTS - INORGANIC (ug/l)
NWIRP, BETHPAGE, NY

ELEMENT	CRDL	UNFILTERED NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION*	FILTERED NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION*
Barium	200	2/2	10.6	2/2	10.6
Calcium	5000	2/2	4700	2/2	4670
Copper	25	2/2	109	2/2	99.2
Iron	100	2/2	70.8	2/2	44.1
Magnesium	5000	2/2	1510	2/2	1480
Manganese	15	2/2	6.2	2/2	6.2
Potassium	5000	2/2	803	1/2	876
Sodium	5000	2/2	26000	2/2	27500
Zinc	20	2/2	29.7	2/2	31

* In a sample population of this size, the representative concentration equals the maximum positive concentration.
CRDL - Contract Required Detection Limit.

173

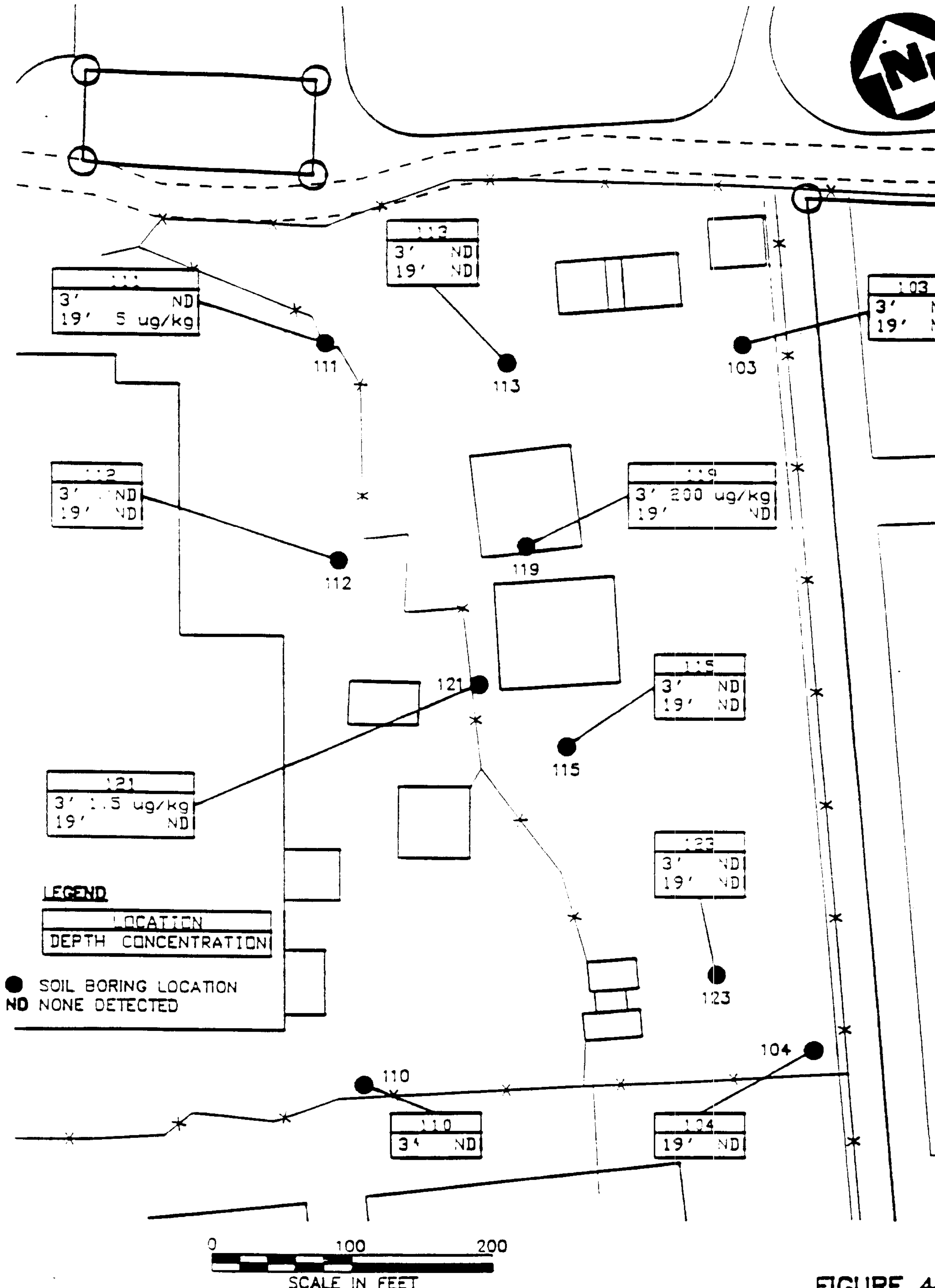
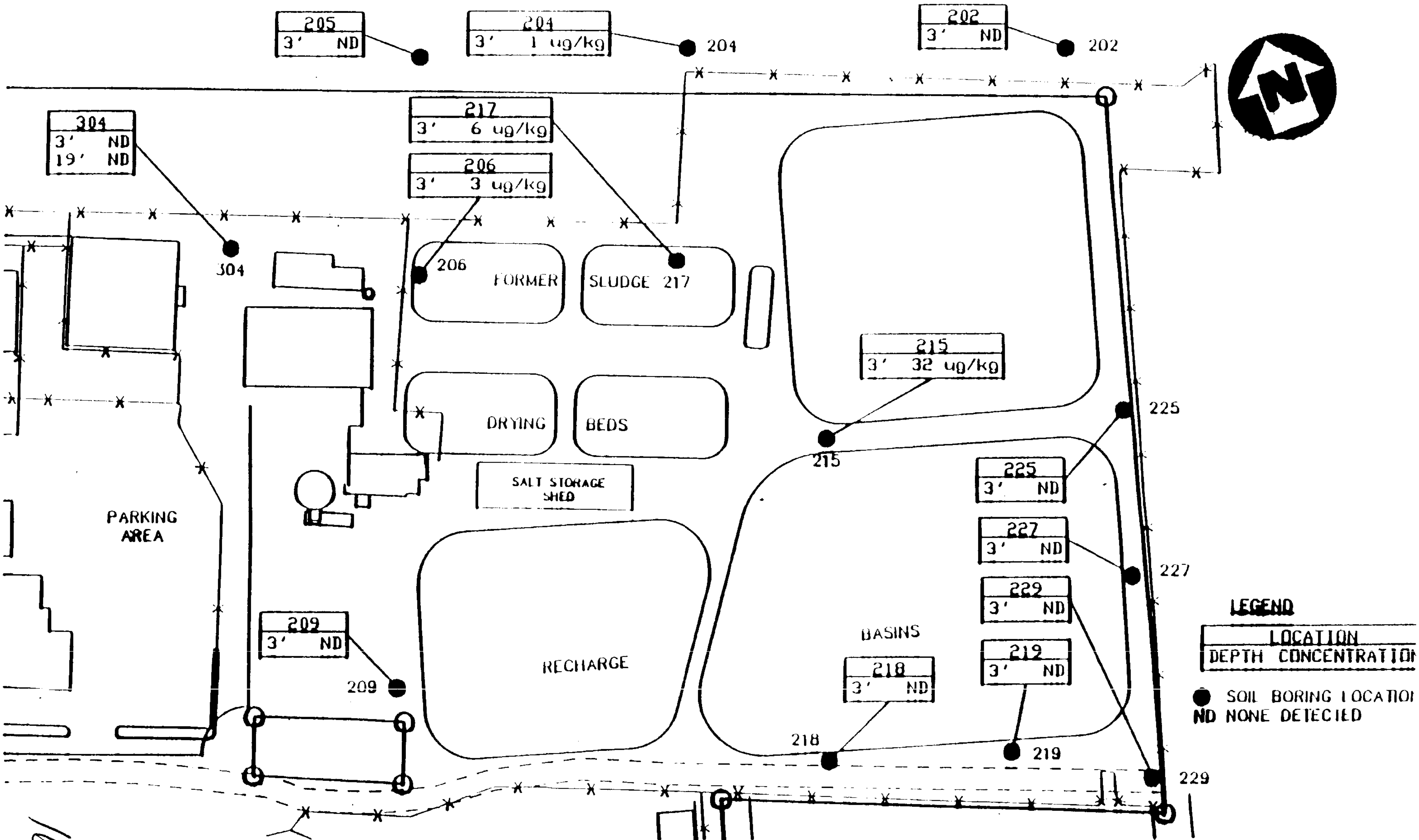


FIGURE 4

165

SITE 1 – SUBSURFACE SOIL RESULTS – TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON
Environmental Corpo



166

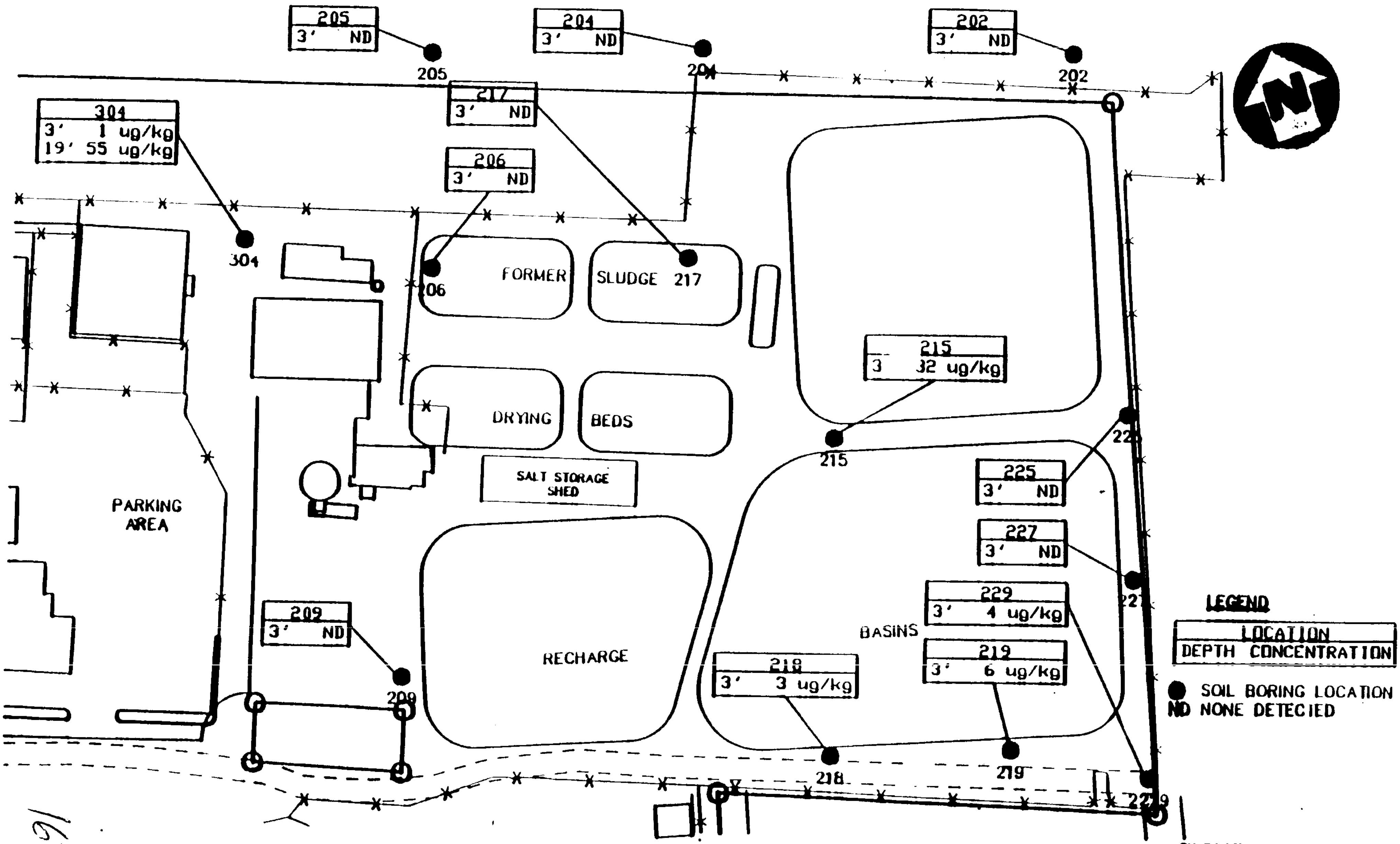
FIGURE 4-7

SITE 2 - SUBSURFACE SOIL RESULTS - TCE

REMEDIAL INVESTIGATION

HALLIBURTON NUS

ACAD: 3281\SITE2.DWG 1/30/92 MB



167

SITE 2 – SUBSURFACE SOIL RESULTS – PCE

FIGURE 4-8

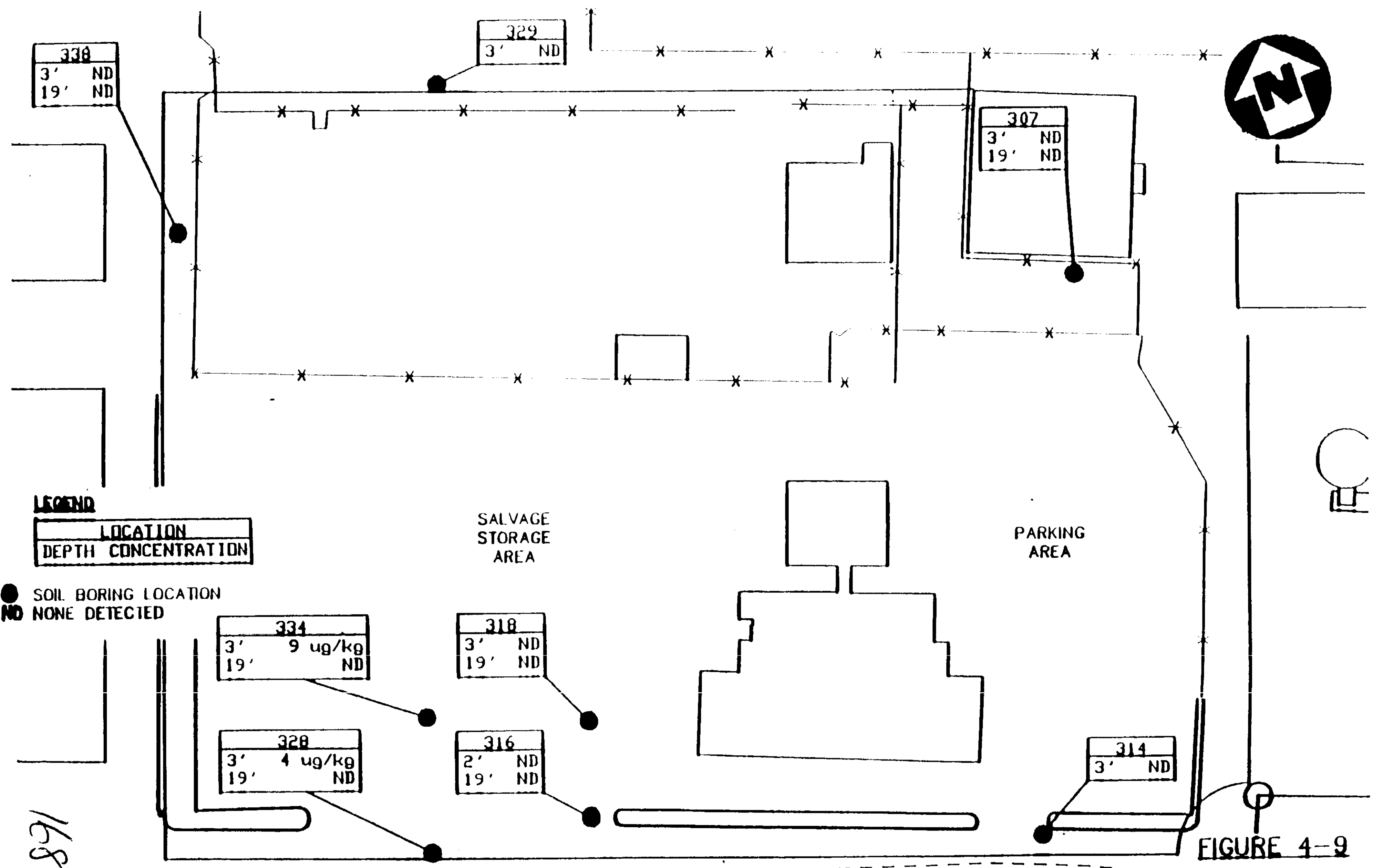


FIGURE 4-9

SITE 3 - SUBSURFACE RESULTS - TCE

HALLIBURTON NUS

188

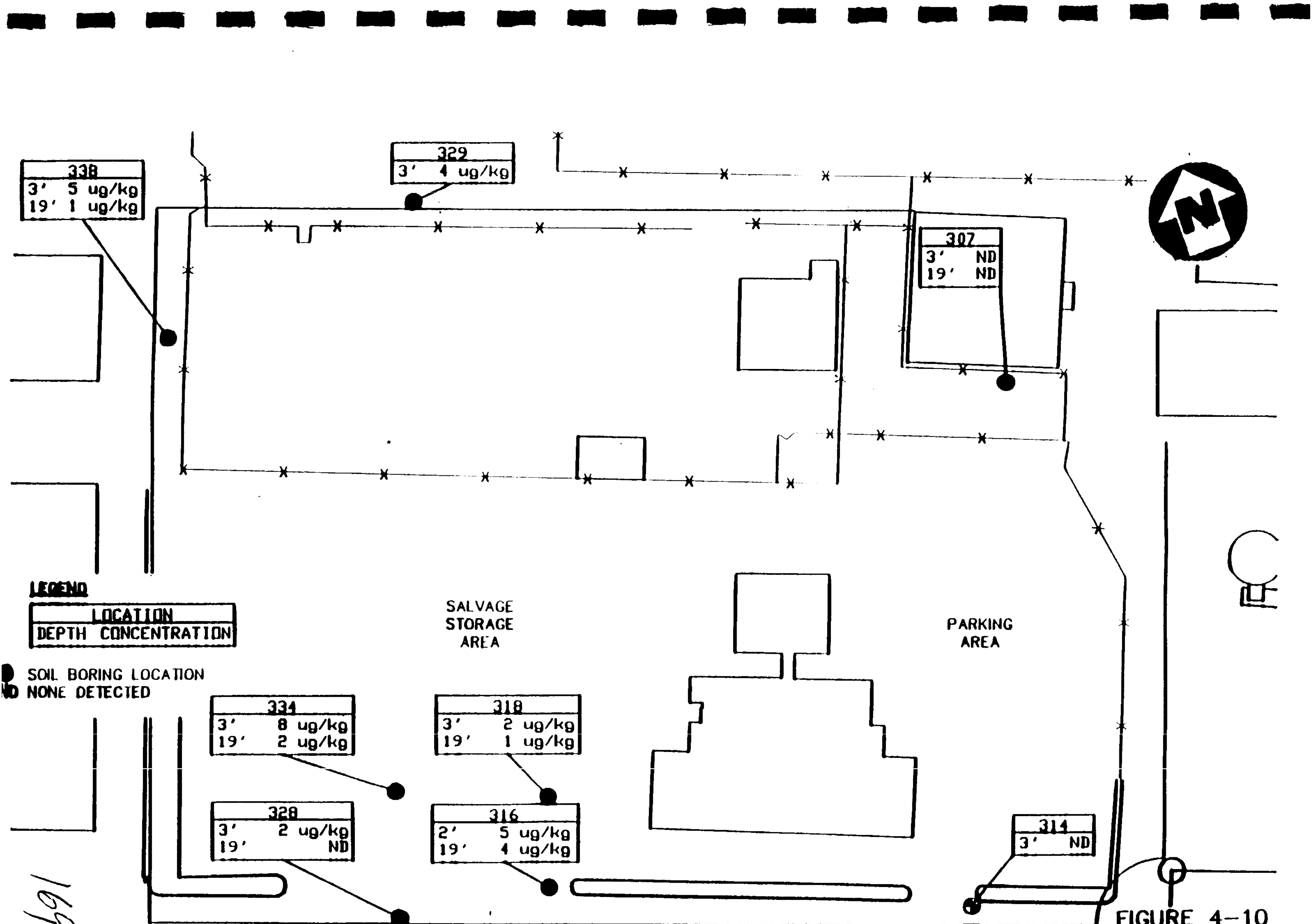


FIGURE 4-10

SITE 3 - SUBSURFACE RESULTS - PCE

169

Chlorinated solvents were detected at trace levels in background soil samples (See Table 4-3). PAHs were also detected in background soil samples, up to approximately 7000 ug/kg.

Table 4-7 displays inorganic analytical results for subsurface soil. Site 3, which generally exhibited the greatest inorganic surface contamination, exhibited the lowest inorganic subsurface contamination. The reverse was true for Site 2. Concentrations of some metals (e.g., barium, iron) were consistent across all three sites. The following metals were detected at the highest concentrations in Site 2: chromium, copper, lead, mercury, silver, and zinc. These metals can be associated with plating (Sittig, 1985).

The highest-concentration sample in Site 1 was one of a field duplicate pair at SB-121; this was located roughly in the center of Site 1, southwest of the former drum marshaling areas. However, the high arsenic result and the high result for cyanide in SB-119 are notable. SB-119 is located at drum marshaling area No. 2. The highest-concentration samples in Site 2 were SB-229 and SB-217, with various high-concentration detections scattered throughout the site. SB-229 was located in the southwestern corner of Site 2, while SB-217 was located in the area of the former sludge drying beds. Sample SB-206, located near SB-217, also exhibited notable levels of several metals. The highest-concentration samples in Site 3 are SB-334 and SB-328, which were located in the southwestern part of Site 3.

4.4 Recharge Basins

Water and sediment samples were obtained from the recharge basins. Sample locations are displayed on Figure 2-6.

4.4.1 Recharge Basin Water

Recharge basin surface water results are presented in Tables 4-8 and 4-9. Table 4-8 displays organic contaminants detected in surface water.

Trace-to-low-level VOCs were identified in the recharge basins, along with a low-level phthalate ester. The most notable result is that of TCE at 35 ug/l. The distribution of TCE, PCE, and 1,1,1-TCA concentrations in surface water can be seen in Figure 4-11.

Table 4-9 displays inorganic elements detected in surface water. Both filtered and unfiltered samples were obtained.

It can be seen that the filtered and unfiltered sample results for the recharge basin water are very similar, with only iron displaying a significant reduction in the filtered result. None of the results in Table 4-9 exceed drinking water criteria (See Table 6-5 in Section 6.0).

TABLE 4-7

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED				CONCENTRATION RANGE			REPRESENTATIVE CONCENTRATION*		
	CRDL	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3	SITE 1	SITE 2	SITE 3
Aluminum	40	9/9	9/9	8/8	1010-11429	1600-7940	1530-10400	6832	6767	6666
Antimony	12	1/9	0/9	0/8	ND-9.8	-	-	5.2	-	-
Arsenic	2	8/9	7/9	6/8	ND-3380	ND-10.7	ND-4.6	1244	5.9	3.0
Barium	40	9/9	9/9	8/8	4.1-30.73	3.1-22	3.3-28.5	17.6	17.6	19.0
Beryllium	1	0/9	0/9	0/8	-	-	-	-	-	-
Cadmium	1	2/9	3/9	0/8	ND-4.5	ND-1.4	-	2.0	1.0	-
Chromium	2	9/9	9/9	8/8	2.7-10.94	2.5-40.15	2.4-9.9	9.5	22.7	8.2
Cobalt	10	1/9	0/9	0/8	ND-4.3	-	-	3.0	-	-
Copper	5	7/9	7/9	6/8	ND-7.9	ND-60.85	ND-15.8	5.4	33.1	11.1
Iron	20	9/9	9/9	8/8	2210-12913	5360-12300	4060-14300	8400	10676	10480
Lead	0.6	9/9	9/9	7/8	1-5.3	1-43.4	ND-19.7	4.5	28.2	10.9
Manganese	3	9/9	9/9	8/8	15.1-167	30.95-182	52.1-267	126	130	192
Mercury	0.1	1/9	4/9	2/8	ND-0.108	ND-0.32	ND-0.22	0.07	0.18	0.15
Nickel	8	2/9	1/9	0/8	ND-6.0	ND-5.8	-	4.3	3.8	-
Selenium	1	0/9	0/9	0/8	-	-	-	-	-	-
Silver	2	0/9	4/9	0/8	-	ND-2.65	-	-	1.3	-
Thallium	2	0/9	0/9	0/8	-	-	-	-	-	-
Vanadium	10	7/9	8/9	8/8	ND-17.9	ND-19.3	4.2-20.5	11.8	15.3	13.0
Zinc	4	9/9	9/9	8/8	7.9-19.4	5.2-74	5.9-28.8	14.4	39.3	20.1
Cyanide	2	2/9	0/9	0/8	ND-13.27	-	-	6.0	-	-

* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected; - = Not detected; CRDL = Contract Required Detection Limit.

TABLE 4-8

OCCURRENCE AND DISTRIBUTION OF
SURFACE WATER CONTAMINANTS - ORGANIC (ug/l)
NWIRP, BETHPAGE, NY

COMPOUND	CRQL	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION*
1,1-Dichloroethene	5	1/2	1
1,1,1-Trichloroethane	5	2/2	6
Trichloroethene	5	2/2	35
Tetrachloroethene	5	1/2	3
Bis (2-ethylhexyl) phthalate	10	2/3	2
PCE (TIC)		1/3	7
TCA (TIC)		1/3	5

* In a sample population of this size, the representative concentration equals the maximum positive concentration.

TIC = Tentatively identified compound.
PCE = Tetrachloroethene.
TCA = Trichloroethane.
CRQL = Contract Required Quantitation Limit.

TABLE 4-9

OCCURRENCE AND DISTRIBUTION
OF SURFACE WATER CONTAMINANTS - INORGANIC (ug/l)
NWIRP, BETHPAGE, NY

ELEMENT	CRDL	UNFILTERED NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION*	FILTERED NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION*
Barium	200	2/2	10.6	2/2	10.6
Calcium	5000	2/2	4700	2/2	4670
Copper	25	2/2	109	2/2	99.2
Iron	100	2/2	70.8	2/2	44.1
Magnesium	5000	2/2	1510	2/2	1480
Manganese	15	2/2	6.2	2/2	6.2
Potassium	5000	2/2	803	1/2	876
Sodium	5000	2/2	26000	2/2	27500
Zinc	20	2/2	29.7	2/2	31

* In a sample population of this size, the representative concentration equals the maximum positive concentration.
CRDL - Contract Required Detection Limit.

173

ACAD: 3281\SITE2.DWG 1/30/92 MB

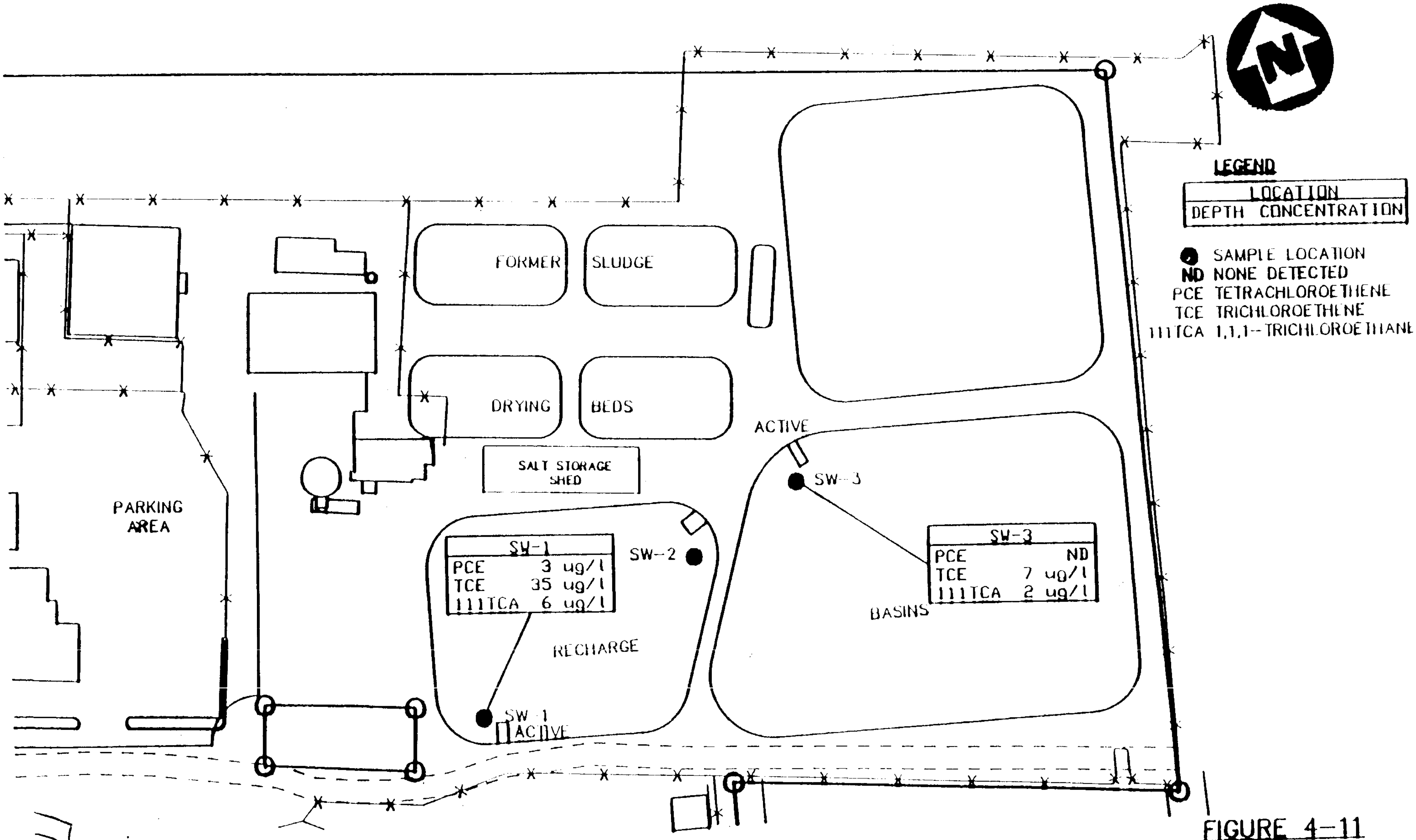


FIGURE 4-11

SITE 2 - SURFACE WATER RESULTS - ORGANICS
REMEDIAL INVESTIGATION

0 150 300

HALLIBURTON NUS

4.4.2 Recharge Basin Sediment

Recharge basin sediment samples were obtained at four locations in Site 2 on two dates (August and December 1991). Analytical results for these samples are summarized in Tables 4-10 and 4-11. One volatile organic compound, PCE, was detected at trace to very low levels in sediment (up to 4 ug/kg). Concentrations of the three major VOCs in sediment can be seen in Figure 4-12. PAHs (less than 15,000 ug/kg, total) and phthalates (less than 1000 ug/kg, total) were also detected in sediment at concentrations similar to those reported elsewhere at the activity. A tentatively identified PCB, trichlorobiphenyl, was reported in sediment up to approximately 170 ug/kg.

Concentrations of metals in sediment were generally lower than concentrations reported in soil. Notable inorganic sediment contaminants included chromium (up to 18 mg/kg), copper (ranging from 51.5 to 89.9 mg/kg), and silver (up to 0.3 mg/kg).

4.5 Groundwater

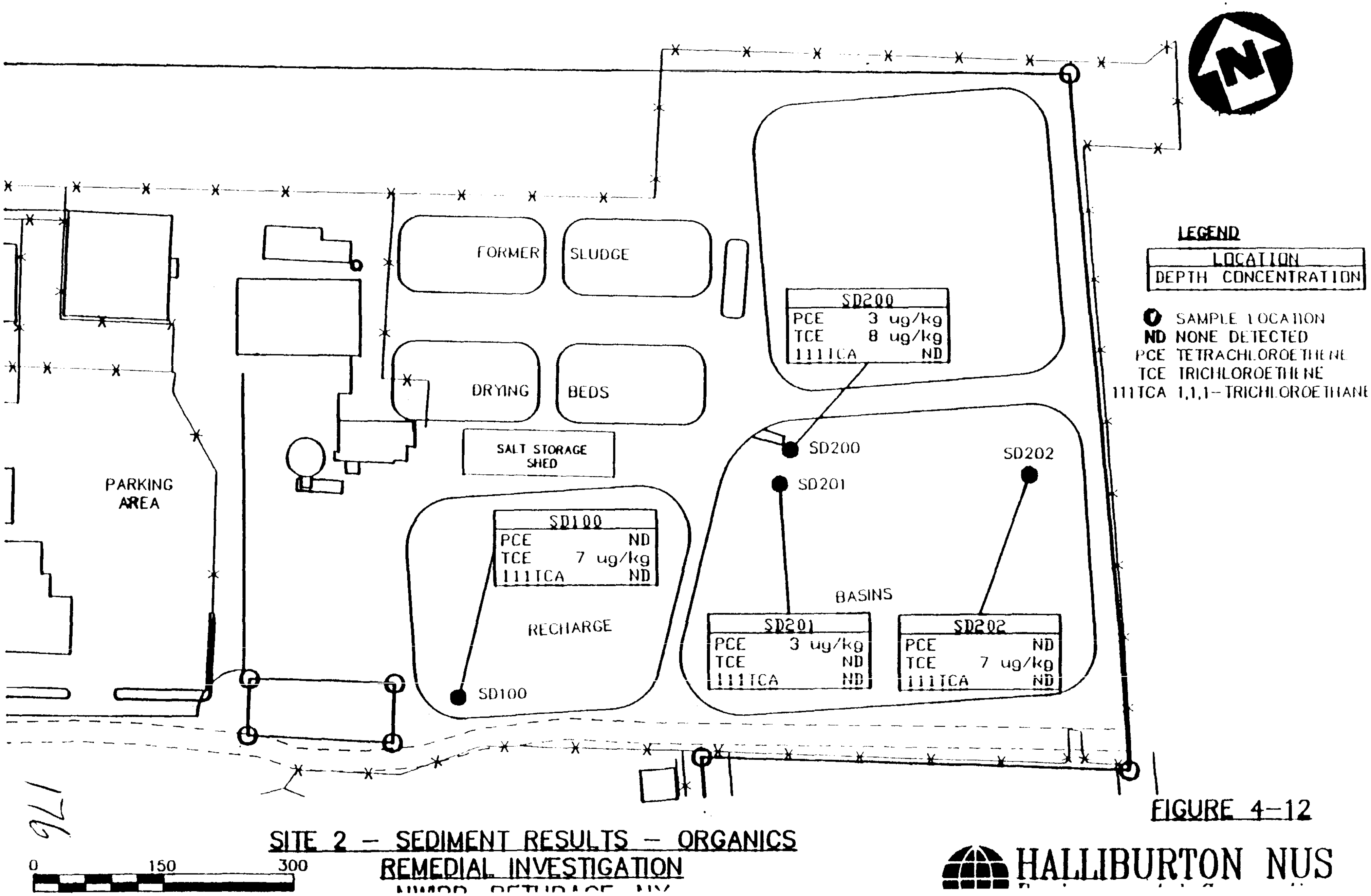
Regional groundwater contamination by TCE, PCE, 1,1,1-TCA, 1,2-Dichloroethane (1,2-DCA), and 1,1-Dichloroethene (1,1-DCE) has been reported in the past (Geraghty & Miller, 1990). Therefore, on-site monitoring and production wells were sampled and analyzed. The results of organic analyses are shown in Table 4-12.

The monitoring wells were sampled at shallow and intermediate depths. The monitoring well and production well sample locations are displayed on Figure 2-7.

4.5.1 Monitoring Wells

The results of the organic analyses of monitoring wells are shown in Table 4-12. Groundwater contamination by the VOCs TCE, PCE, and 1,1,1-TCA is illustrated in Figures 4-13, 4-14, and 4-15 from shallowly-screened wells and in Figures 4-16, 4-17, and 4-18 from wells screened at intermediate depths. The distribution of organic contaminants detected above MCLs is displayed on Figures 4-19 and 4-20.

It can be seen that chlorinated ethenes and ethanes were detected in most wells. Most notable were concentrations of TCE ranging up to 58,000 ug/l, concentrations of PCE ranging up to 3,600 ug/l, concentrations of 1,2-Dichloroethene (1,2-DCE) ranging up to 3,600 ug/l, concentrations of 1,1-Dichloroethane (1,1-DCA) ranging up to 250 ug/l, concentrations of 1,1,1-TCA ranging up to 10,000 ug/l, and concentrations of 1,1-DCA ranging up to 880 ug/l. Most of these maximum concentrations were reported in HN29S, which is located in the southwestern part of Site 1. Concentrations of chlorinated ethenes and ethanes of several hundred ug/l were



176

FIGURE 4-12

SITE 2 - SEDIMENT RESULTS - ORGANICS
REMEDIAL INVESTIGATION

HALLIBURTON NUS

TABLE 4-10

OCCURRENCE AND DISTRIBUTION
OF RECHARGE BASIN SEDIMENT - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

COMPOUND	CRQL	NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED - 8/28	MAXIMUM POSITIVE CONCENTRATION*	NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED - 12/12	MAXIMUM POSITIVE CONCENTRATION*
Trichloroethene	5	-	-	2/2	8
Tetrachloroethene	5	2/2	4	1/2	3
Phenanthrene	330	2/2	175	2/2	430
Fluoranthene	330	2/2	225	2/2	860
Pyrene	330	2/2	235	2/2	610
Chrysene	330	2/2	125	2/2	370
Benzo[b]fluoranthene	330	2/2	126.5	2/2	650
Benzo[k]fluoranthene	330	2/2	130	-	-
Benzo[a]pyrene	330	2/2	118.5	2/2	260
Benzo[g,h,i]perylene	330	2/2	95	2/2	290
Benzo[a]anthracene	330	2/2	69.75	2/2	240
Indeno[1,2,3-c,d]pyrene	330	2/2	91	2/2	270
Di-n-butylphthalate	330	1/2	102	-	-
Butylbenzylphthalate	330	1/2	250	-	-
Bis(2-ethylhexyl)phthalate	330	2/2	310	2/2	430
PCB (TIC - TCB)		2/2	170	-	-

TIC = Tentatively Identified Compound
PCB = Polychlorinated biphenyl
TCB = Trichlorobiphenyl

* In a sample population of this size, the representative concentration equals the maximum detection.
CRQL = Contract Required Quantitation Limit.

177

TABLE 4-11

OCCURRENCE AND DISTRIBUTION
OF RECHARGE BASIN SEDIMENT - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

COMPOUND	CRDL	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED - 8/28	RANGE OF CONCENTRATIONS*	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED - 12/12	RANGE OF CONCENTRATIONS
Aluminum	40	2/2	1030-1110	2/2	1020-1340
Antimony	12	0/2	-	0/2	-
Arsenic	2	2/2	1.7-2.8	2/2	0.83-1.6
Barium	40	2/2	5.15-5.3	2/2	4-6.3
Beryllium	1	0/2	-	0/2	-
Cadmium	1	0/2	-	1/2	ND-0.41
Calcium	1000	0/2	ND-165.5	2/2	109-176
Chromium	2	2/2	9.8-18	2/2	26.9-27.5
Cobalt	10	0/2	-	0/2	-
Copper	5	0/2	51.5-89.9	2/2	119-141
Iron	20	2/2	5610.47-6480.68	2/2	2680-4510
Lead	0.6	2/2	4.2-5.78	2/2	15.3-23.2
Magnesium	1000	2/2	68.1-155.5	2/2	160-239
Manganese	3	2/2	19.8-74.7	2/2	19.8-28.6
Mercury	0.1	0/2	-	2/2	0.14-0.18
Nickel	8	0/2	-	2/2	3.2-3.8
Potassium	1000	1/2	ND-65.6	0/2	-
Selenium	1	0/2	-	0/2	-
Silver	2	1/2	ND-0.3	1/2	ND-0.96
Sodium	1000	2/2	121-148.5	2/2	21.7-30.1
Thallium	2	0/2	-	0/2	-
Vanadium	10	2/2	8.7-10.35	2/2	4.6-6.5
Zinc	4	2/2	11.8-1835	2/2	14.1-19.2
Cyanide	2	0/2	-	0/2	-

TIC = Tentatively Identified Compound.
PCB = Polychlorinated biphenyl.
TCB = Trichlorobiphenyl.

* In a sample population of this size, the representative concentration equals the maximum detection.
CRDL = Contract Required Detection Limit.

178

TABLE 4-12

OCCURRENCE AND DISTRIBUTION
OF GROUNDWATER CONTAMINATION - ORGANIC (ug/l)
NWIRP, BETHPAGE, NY

COMPOUND	CRQL	NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	MAXIMUM POSITIVE CONCENTRATION	REPRESENTATIVE CONCENTRATION*
Trichloroethene	5	14/15	58000	12285
Toluene	5	5/15	39	11.5
1,1-Dichloroethane	5	3/15	880	188
1,2-Dichlorethene	5	3/15	3600	772
1,1,1-Trichloroethane	5	12/15	10000	2113
Tetrachloroethene	5	12/15	3600	788
1,1-Dichloroethene	5	4/15	250	54.7
Carbon Tetrachloride	5	1/15	8	3.7
Ethylbenzene	5	1/15	3	2.6
Xylenes	5	1/15	19	6.0
TICs		14/15	-	-
Bis(2-ethylhexyl)phthalate	10	15/15	210	84.1
Di-n-octylphthalate	10	2/15	17	7.7
Di-n-butylphthalate	10	1/15	6.5	5.6
2-Methylphenol	10	1/15	2	2
4-Methylphenol	10	1/15	2	2
2,4-Dimethylphenol	10	1/15	7	5.7
Naphthalene	10	1/15	3	3
Acenaphthylene	10	1/15	1	1
Fluoranthene	10	1/15	2	2
Pyrene	10	1/15	2	2
Benzo(b)fluoranthene	10	1/15	2	2

TICs = Tentatively Identified Compounds.
* Upper 95% confidence limit on arithmetic average, or maximum if UCL exceeds maximum positive detection.
- detected.
‹ Contract Required Quantitation Limit.

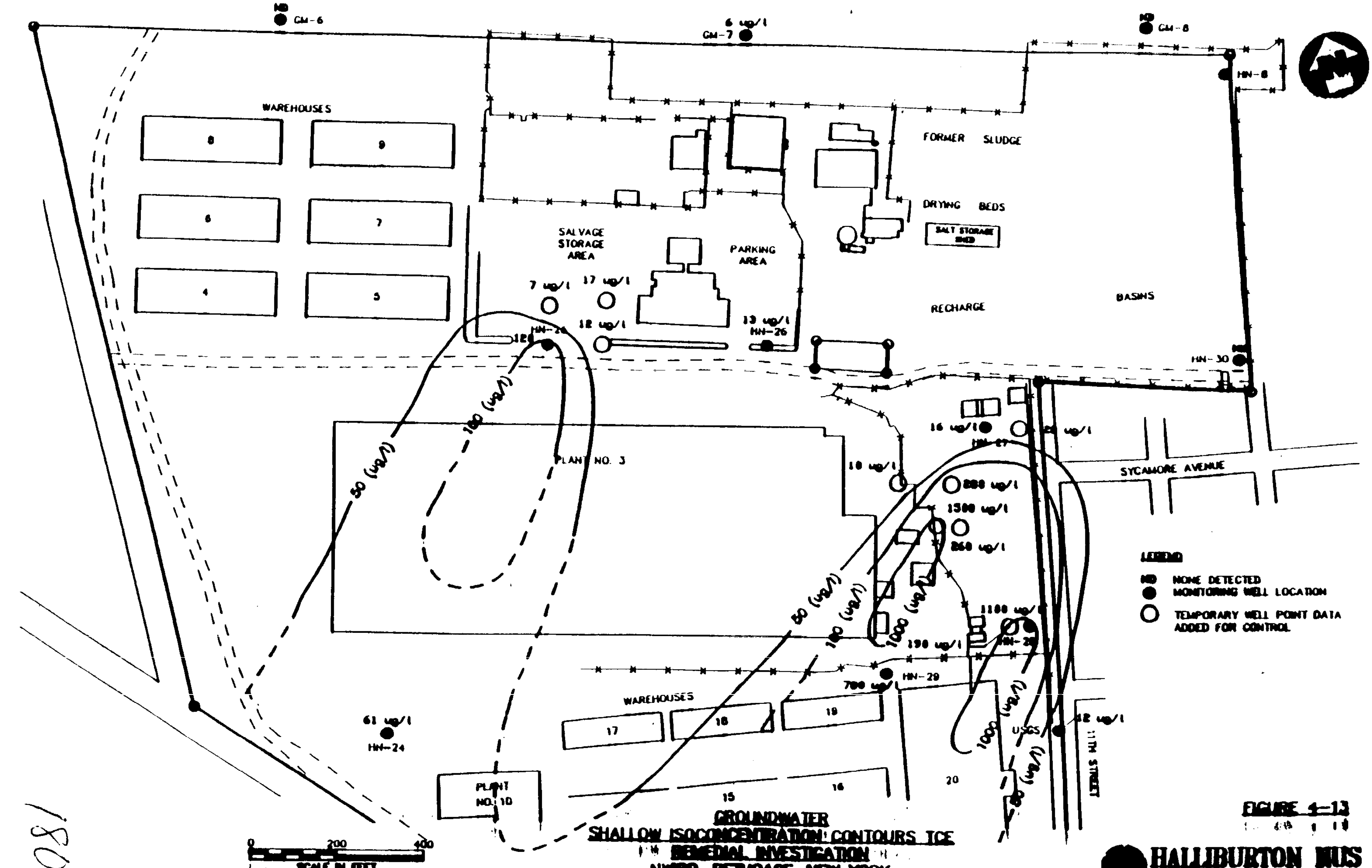


FIGURE 4-13

GROUNDWATER
SHALLOW ISOCONCENTRATION CONTOURS TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

180

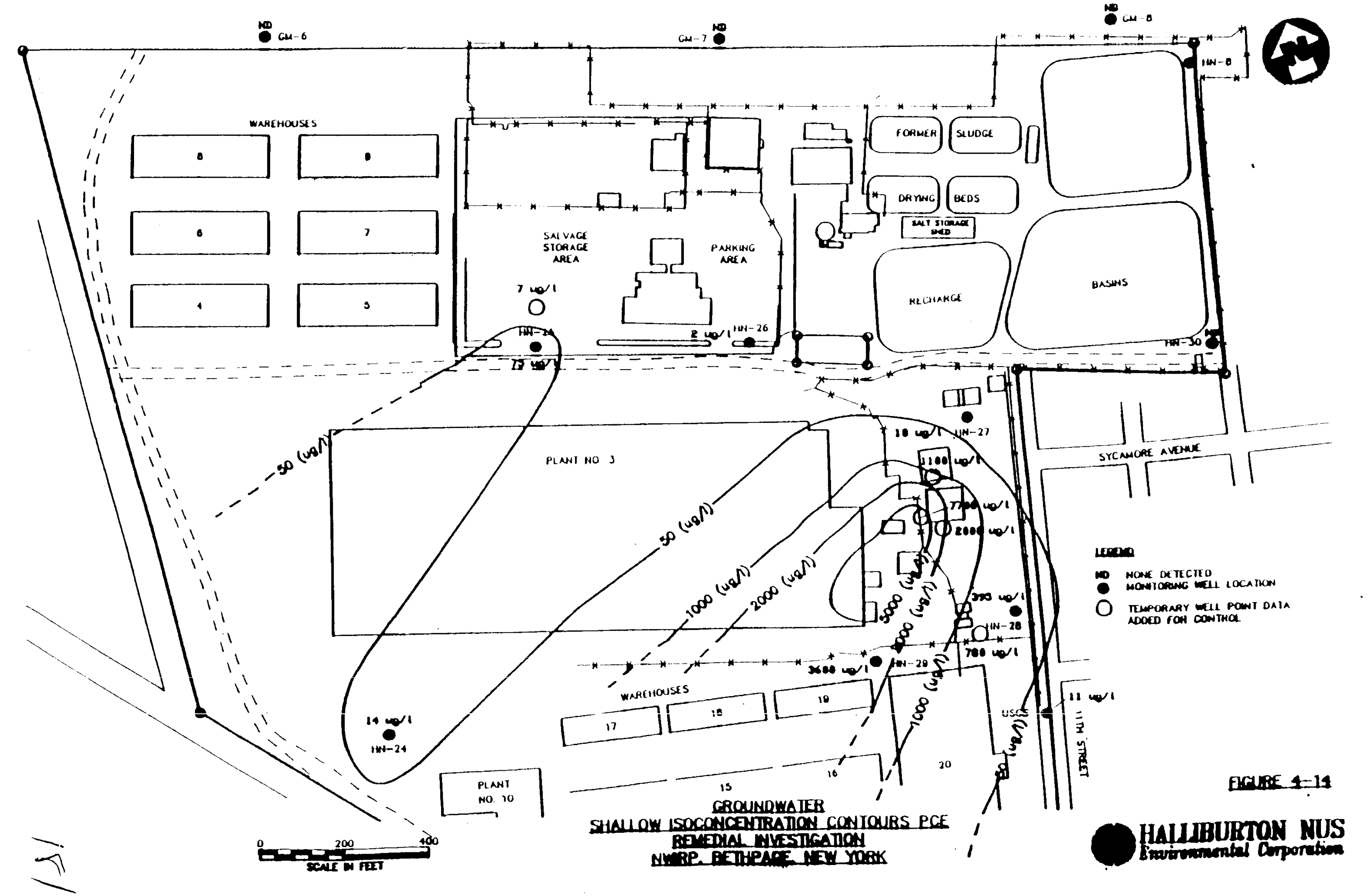


FIGURE 4-14

GROUNDWATER
SHALLOW ISOCONCENTRATION CONTOURS PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

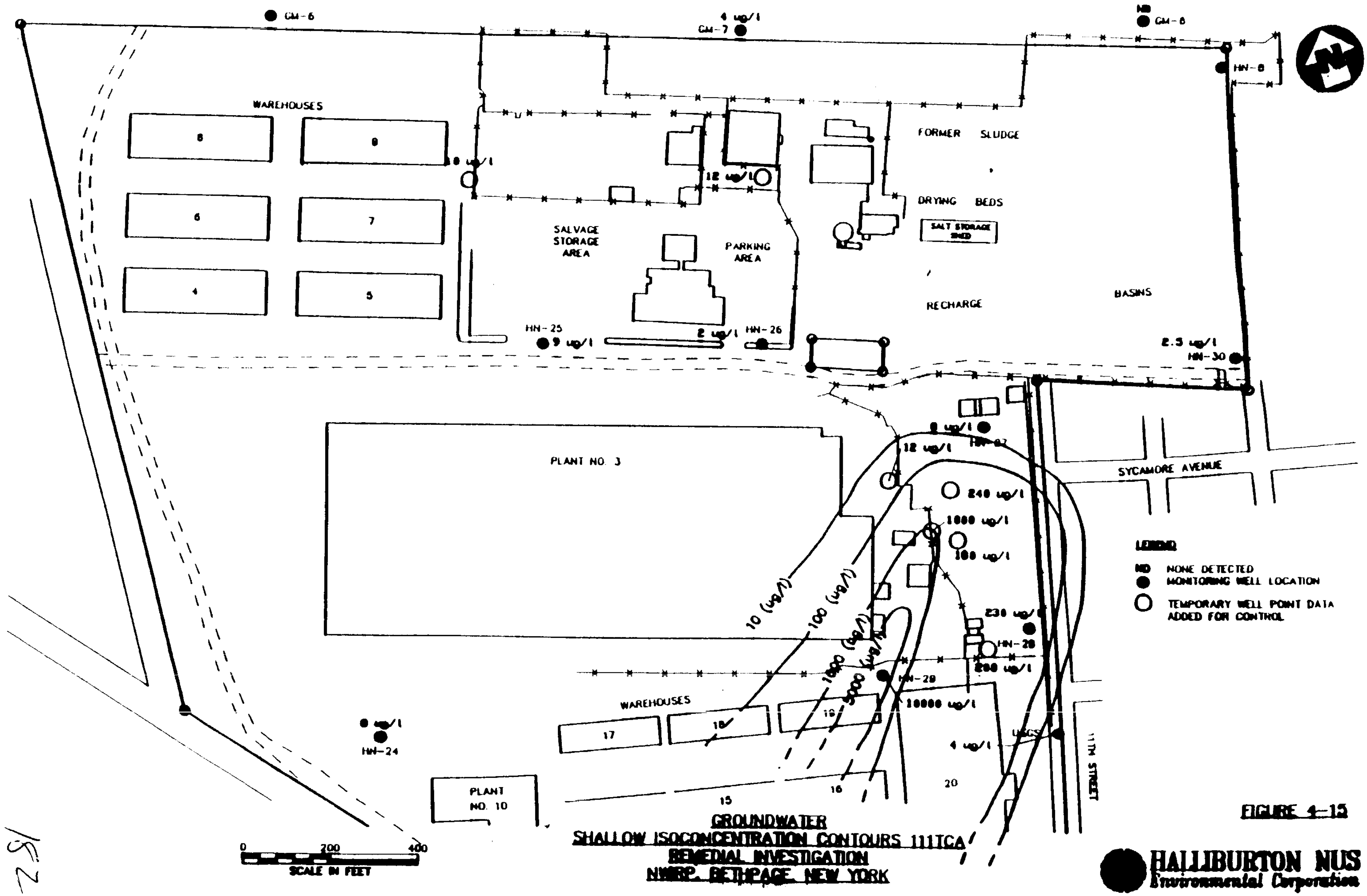


FIGURE 4-15

GROUNDWATER
SHALLOW ISOCONCENTRATION CONTOURS 111TCA
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

152

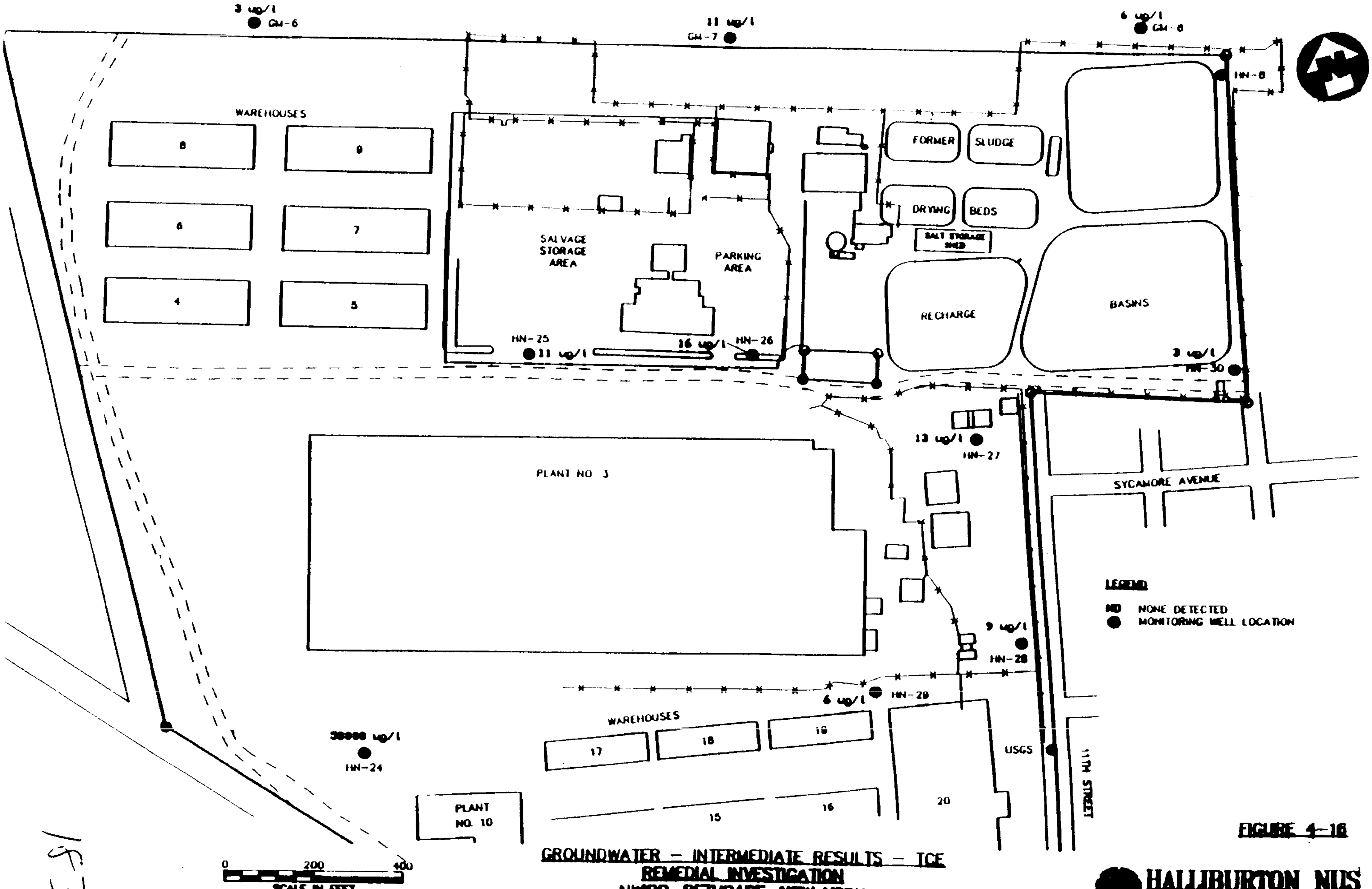


FIGURE 4-16

GROUNDWATER - INTERMEDIATE RESULTS - TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

153

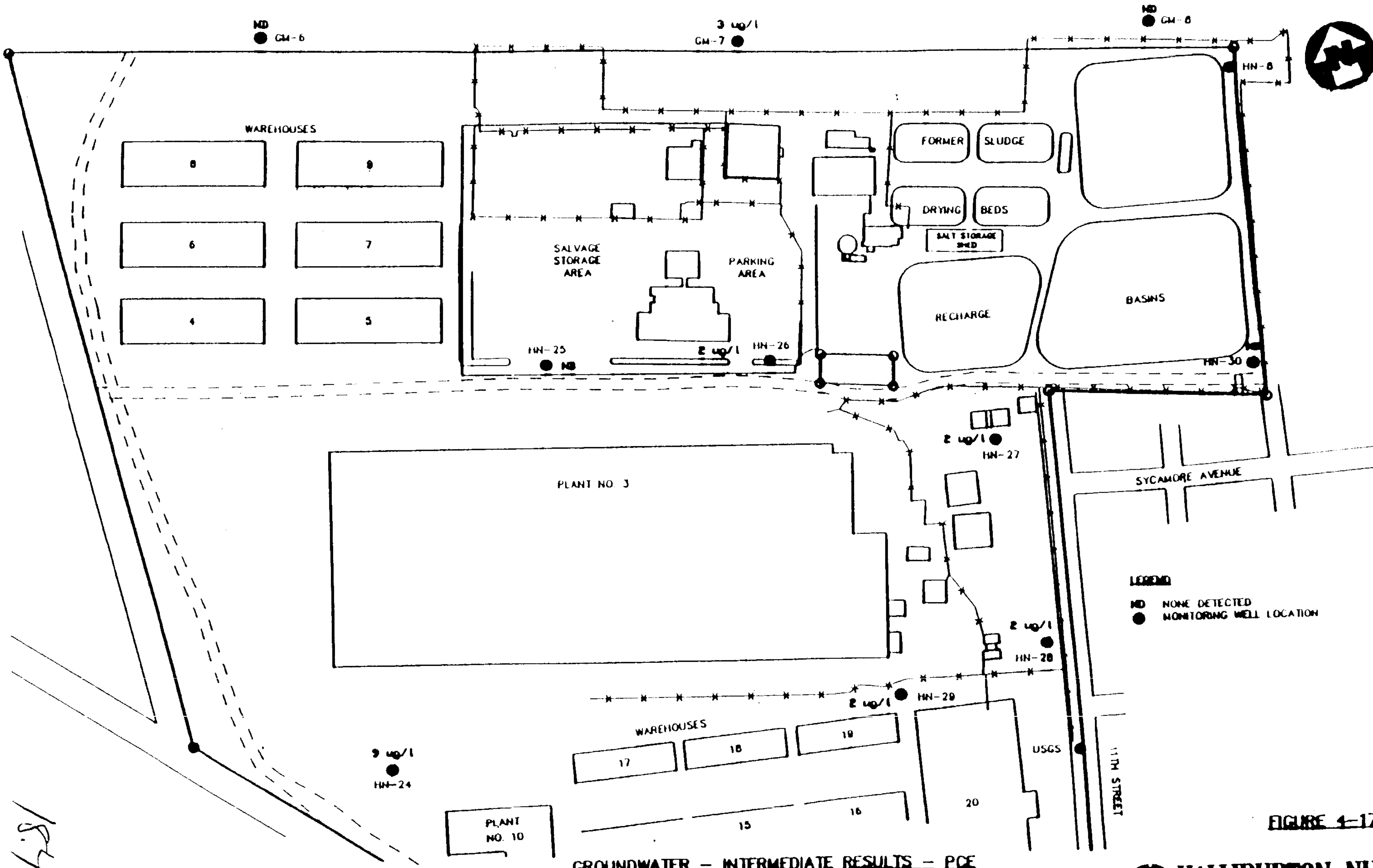


FIGURE 4-17

GROUNDWATER – INTERMEDIATE RESULTS – PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

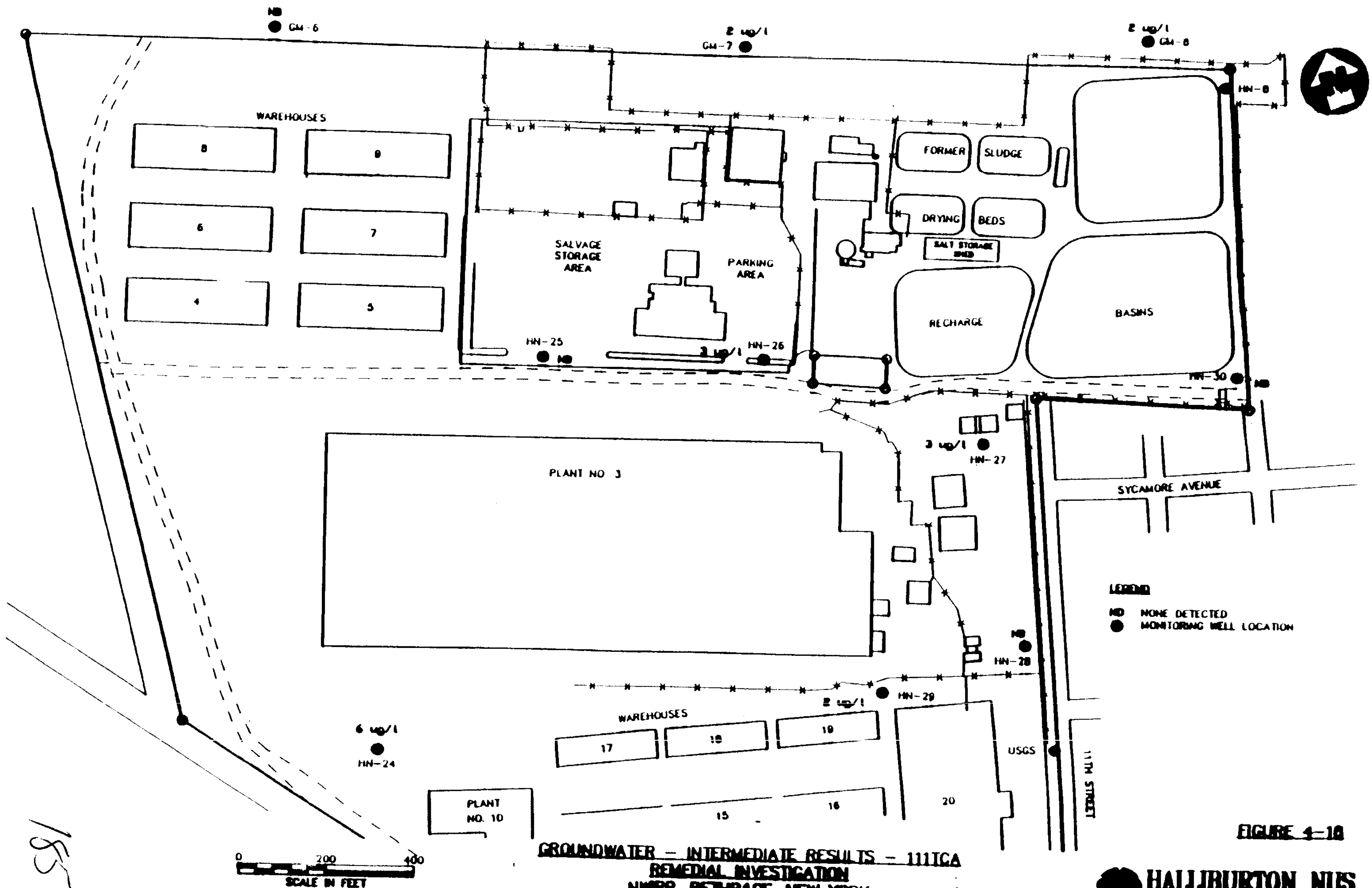


FIGURE 4-18

GROUNDWATER - INTERMEDIATE RESULTS - 111TCA
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

185

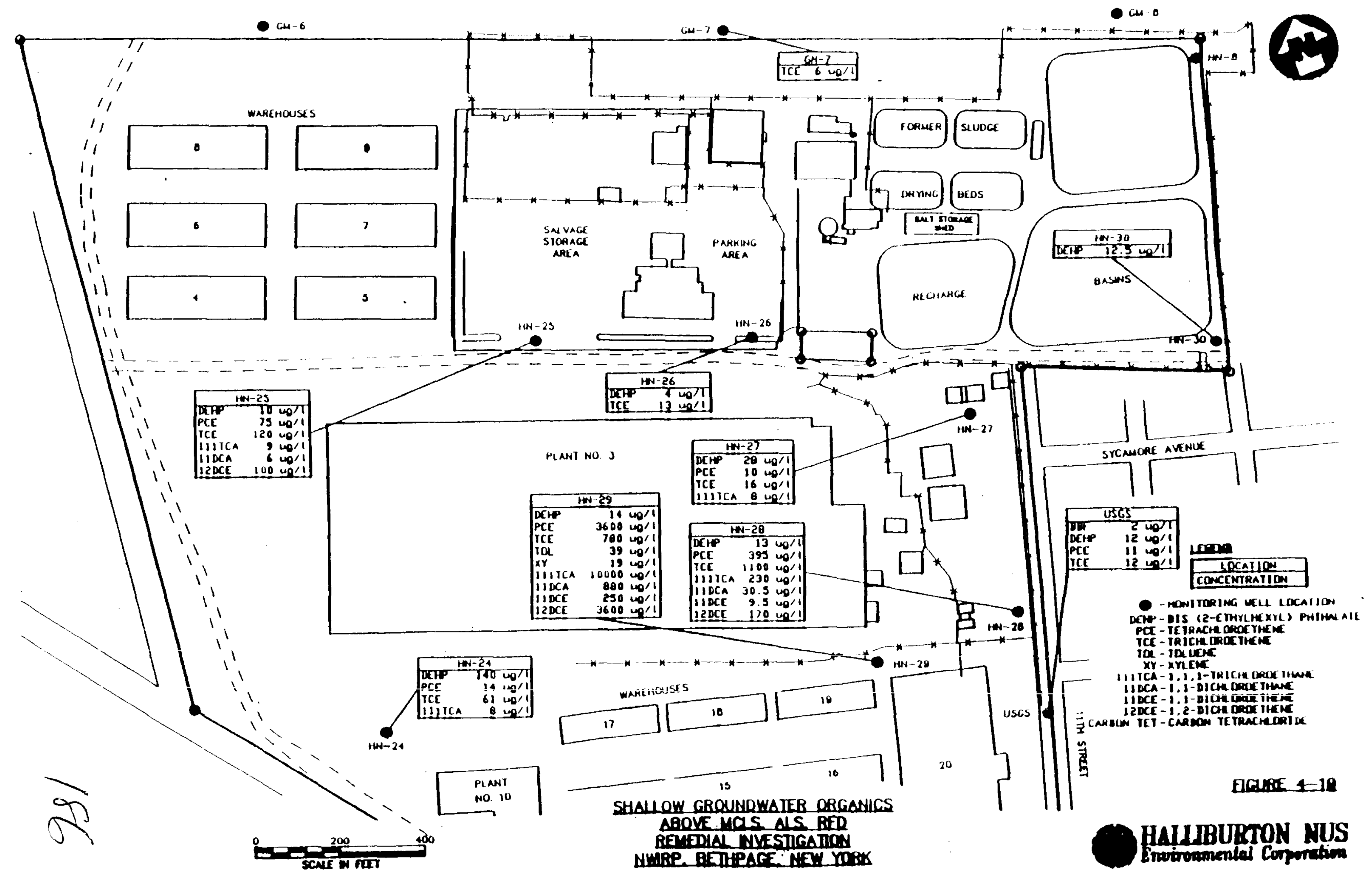


FIGURE 4-18

SHALLOW GROUNDWATER ORGANICS
ABOVE MCLS, ALS, RFD
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

186

reported for HN28S, which is located in the southeastern portion of Site 1.

This is south of the former drum marshaling areas, where significant VOC soil contamination was reported (see Section 4.3). The maximum TCE concentration was detected in HN24I, which was located at the southwestern corner of Plant No. 3. HN25S also exhibited significant VOC contamination, although concentrations were less than those reported for HN29 and HN24. The lowest levels of organic contamination were observed for HN30S (southeastern corner of Site 2).

For comparative purposes, VOCs detected in Grumman wells north of Site 1 (sampled in October 1991) are displayed here:

Chemical	GM6S	GM6I	GM7S	GM7I	GM7D	GM8S	GM8I
1,1,1-TCA	ND	ND	4J	2J	2J	ND	2J
TCE	ND	3J	6	11	8	ND	6
PCE	ND	ND	ND	3J	ND	ND	ND

It can be noted that concentrations of VOCs in HN25I and HN25S (in the southernmost part of Site 3) are greater than those of the Grumman wells, and VOC concentrations in HN28 and HN29 (in the southern part of Site 1) are even greater.

Generally, VOCs are greater in shallow wells than in the intermediate wells, with the notable exception being TCE in G24I. Some VOCs were detected infrequently, including carbon tetrachloride, ethylbenzene, and xylenes. The ethylbenzene and xylenes, along with substituted phenols and PAHs, were all detected in HN29S. It is unusual to find PAHs in groundwater; usually, they are assumed to be contained in the sediment (or oil) fractions of a monitoring well sample. Only one other well yielded PAHs (the USGS well). All PAHs were detected at trace concentrations in the southern part of Site 1.

Phthalates were detected in almost every well sample; however, the one most frequently detected, bis (2-ethylhexyl) phthalate (DEHP), is a common laboratory contaminant. The highest DEHP levels occurred in the following wells: HN28I (210 ug/l) (south, site 1); HN24S (140 ug/l) (southwest of Plant No. 3); and HN30I (140 ug/l) (southeast, Site 2).

TICs were detected in almost every well. TICs included PAHs, substituted benzenes, alkanes, substituted phenols, chlorinated ethenes, and carboxylic acids.

Both filtered and unfiltered groundwater samples were obtained from on-site wells. The unfiltered inorganic results are presented in

187

Table 4-13. These are the data which will be used in the quantitative risk assessment, in accordance with EPA policy. However, many monitoring wells contain significant amounts of sediment, which may result in overestimation of risks from metals in groundwater. Therefore, filtered results are also presented (see Table 4-14) and will be referred to as needed. The distribution of inorganics above MCLs or health-based levels in unfiltered monitoring wells is shown in Figures 4-21 and 4-22.

It can be seen from a comparison of Tables 4-13 and 4-14 that there are significantly lower concentrations of most metals in the filtered samples. Some inorganics, such as beryllium, cobalt, mercury, and nickel, were detected in the unfiltered samples but were not detected in the filtered samples.

Results for total chromium and hexavalent chromium are presented in Table 4-13. Because the proportions of trivalent and hexavalent chromium in the total chromium cannot be accurately determined, both the total and hexavalent results are given. For purposes of risk assessment, chromium will be assumed to be hexavalent where hexavalent chromium was not analyzed. Total chromium will be treated as trivalent and hexavalent chromium will be treated as hexavalent in the risk assessment for groundwater. Although this will result in some overestimation of risk, the toxicity of trivalent chromium is low enough, especially relative to hexavalent chromium, that its impact on the quantitative assessment will be negligible.

Notable results in unfiltered monitoring wells include arsenic in HN25S (99.1 ug/l); beryllium in HN27S (2.9 ug/l) and HN29S (2.8 ug/l); cadmium in HN27S (392 ug/l); chromium in HN27S (169 ug/l), USGS (85.7 ug/l), and HN28I (59.2 ug/l); iron in USGS (125000 ug/l), HN29S (93000 ug/l), HN25S (155000 ug/l), and HN27S (106000 ug/l); lead in USGS (124 ug/l); vanadium in HN25S (359 ug/l) and HN29S (419 ug/l); thallium in HN24I (3.1 ug/l). Notable results in filtered samples include cadmium in HN27S (91 ug/l); chromium in HN28I (56.7 ug/l); thallium in HN29S (1.7 ug/l) and HN24S (17.1 ug/l). There is no clear pattern or definable plume of inorganic contamination, although inorganic concentrations were highest in HN25S, HN27S, and HN29S.

4.5.2 Production Wells

Four production wells were sampled (see Figure 2-7). These wells, which are screened at a much greater depth than the monitoring wells, were reported to be used for industrial purposes such as cooling. The base is reported to be supplied from public water supply wells. Therefore, these results will not be included in the quantitative risk assessment for wells screened at shallow and intermediate depths. Production well results are presented in Table 4-15. The distribution of concentrations of organics detected in production wells is shown on Figure 4-23.

TABLE 4-13

OCCURRENCE AND DISTRIBUTION
OF GROUNDWATER INORGANICS - UNFILTERED (ug/l)
NWIRP, BETHPAGE, NY

ELEMENT	CRDL	NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	CONCENTRATION RANGE	REPRESENTATIVE CONCENTRATION*
Aluminum	200	15/15	51.1-33800	13275
Arsenic	10	12/15	ND-99.1	26.7
Barium	200	15/15	9.7-211	106.8
Beryllium	5	2/15	ND-2.9	1.3
Cadmium	5	5/15	ND-392	83.0
Calcium	5000	15/15	38602-27400	10597
Chromium	10	12/15	ND-169	59.7
		3/15	ND-61	21.1
Hexavalent chromium				7.4
Cobalt	50	5/15	ND-12.8	194
Copper	25	13/15	ND-823	67314
Iron	100	15/15	114-155000	36.9
Lead	3	12/15	ND-124	2552
Magnesium	5000	15/15	277-7950	402
Manganese	15	15/15	7.65-1440	0.13
Mercury	0.2	2/15	ND-0.2	20.2
				12001
Nickel	40	6/15	ND-62.9	0.88
Potassium	5000	15/15	1395-35100	75164
Selenium	5	1/15	ND-2.3	1.0
Sodium	5000	15/15	12100-222000	159
Thallium	10	1/15	ND-3.1	90
Vanadium	50	11/15	ND-419	578
Zinc	20	15/15	7.1-217	
Cyanide	10	4/15	ND-2690	

* Upper 95% confidence limit on arithmetic average, or maximum positive concentration if UCL exceeds maximum.
ND = Not detected.
CRDL = Contract Required Detection Limit.

TABLE 4-14

OCCURRENCE AND DISTRIBUTION
OF GROUNDWATER INORGANICS - FILTERED (ug/l)
NWIRP, BETHPAGE, NY

ELEMENT	CRDL	NUMBER POSITIVE DETECTIONS/SAMPLES ANALYZED	CONCENTRATION RANGE	REPRESENTATIVE CONCENTRATION*
Aluminum	200	5/15	ND-293	113.5
Arsenic	10	7/15	ND-43.2	12.0
Barium	200	9/15	ND-89.1	27.6
Cadmium	5	3/15	ND-91	19.7
Calcium	5000	15/15	2730-31100	11988
Chromium	10	3/15	ND-56.7	18.2
Copper	25	7/15	ND-7.55	3.6
Iron	100	10/15	ND-568	164.4
Lead	3	1/15	ND-6	1.65
Magnesium	5000	14/15	ND-8330	2919
Manganese	15	13/15	ND-572	133.9
Potassium	5000	15/15	1100-35300	11775
Selenium	5	1/15	ND-3.1	1.0
Sodium	5000	15/15	12100-230000	75927
Thallium	10	4/15	ND-17.1	4.1
Vanadium	50	3/15	ND-34.3	9.8
Zinc	20	15/15	7.7-168	85.5

* Upper 95% confidence limit on arithmetic average, or maximum positive detection if UCL exceeds maximum.
ND = Not detected
CRDL = Contract Required Detection Limit.

TABLE 4-15

OCCURRENCE AND DISTRIBUTION
OF PRODUCTION WELL RESULTS (ug/l)
NWIRP, BETHPAGE, NY

	CRQL	NUMBER POSITIVE DETECTIONS/ SAMPLES ANALYZED	CONCENTRATION RANGE*
ORGANICS			
Trichloroethene	5	4/4	6-110
1,1,1-Trichlorethane	5	3/4	ND-20
Tetrachloroethene	5	4/4	2-10
1,1-Dichloroethene	5	3/4	ND-7
Bis(2-ethylhexyl)phthalate	10	3/4	ND-180
TICs		3/4	-
INORGANICS - UNFILTERED			
Arsenic	10	1/4	ND-1
Barium	200	3/4	ND-11
Calcium	5000	4/4	2930-4520
Copper	25	4/4	7-26.8
Iron	100	3/4	ND-181
Lead	3	2/4	ND-6.1
Magnesium	5000	4/4	986-1410
Manganese	15	4/4	1.1-10
Potassium	5000	3/4	ND-716
Sodium	5000	4/4	10400-26700
Zinc	20	4/4	9.2-43.4
INORGANICS - FILTERED			
Barium	200	3/4	ND-10.4
Calcium	5000	4/4	2860-4380
Copper	25	4/4	4.6-24.6
Iron	100	3/4	ND-51.5
Lead	3	2/4	ND-7.8
Magnesium	5000	4/4	975-1350
Manganese	15	4/4	1.3-10.2
Potassium	5000	4/4	650-993
Sodium	5000	4/4	10500-26200
Zinc	20	4/4	13.7-46.2

TIC = Tentatively identified compound.
ND = Not detected.
* In a sample population of this size, the representative concentration equals the maximum positive concentration.
CRQL = Contract Required Quantitation Limit.

Some organic compounds found in soil and in monitoring wells are also found in production wells (TCE, 1,1,1-TCA, PCE, and 1,1-DCE, as well as DEHP). Concentrations of organics in production wells are lower than those in monitoring wells, although they exceeded concentrations in the Grumman wells. Inorganics were detected at generally lower levels than those found in monitoring wells, which is not unusual when comparing constantly-pumped wells to seldom-pumped monitoring wells. There is also little difference between the filtered and unfiltered production well results.

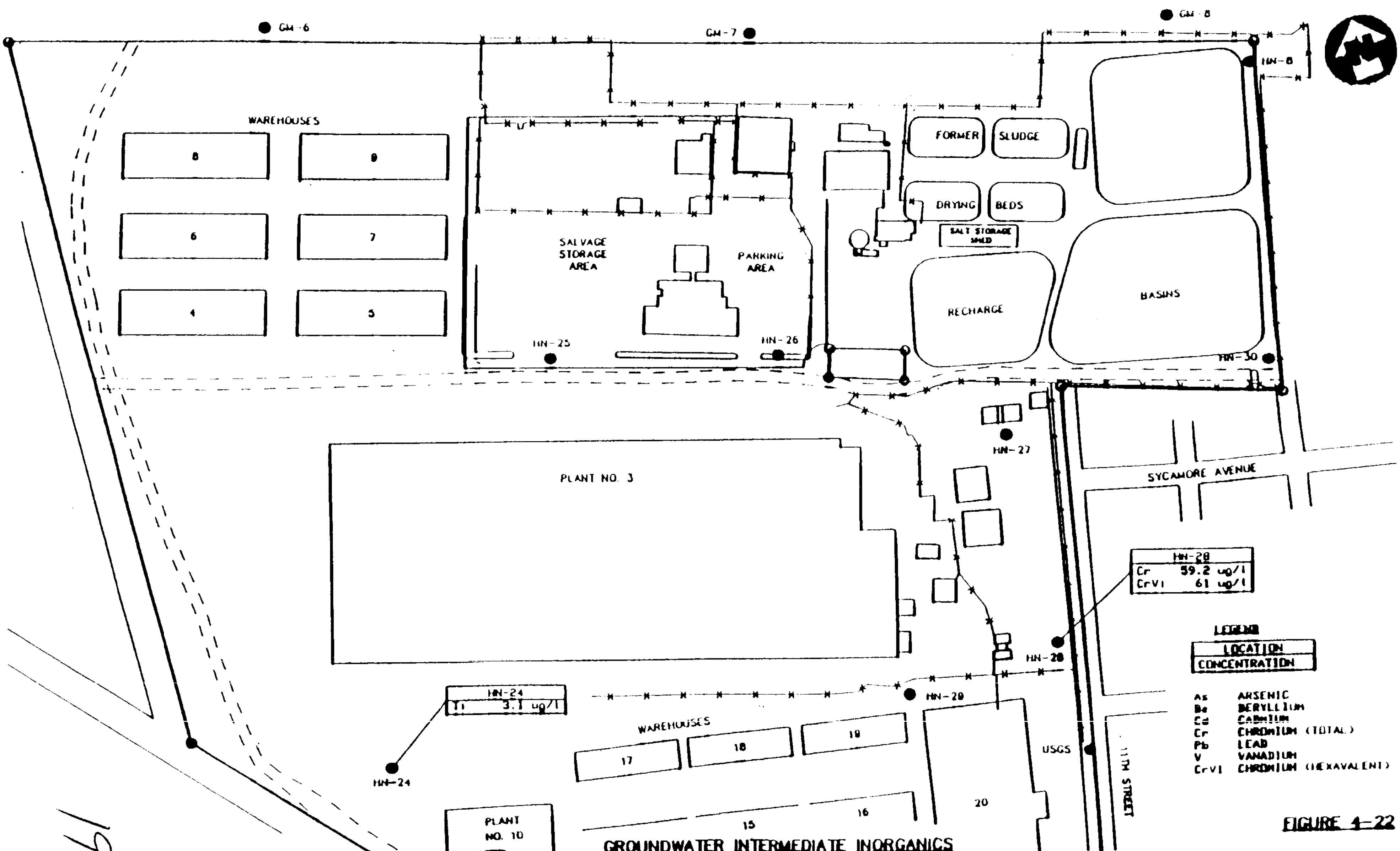
4.6 Summary

VOC contamination, especially by chlorinated ethanes and chlorinated ethenes, is evident in soil and groundwater. The highest concentrations were found at in Site 1, especially near the drum marshaling areas. One well, HN24I, located southwest of the three sites, also exhibited a significant concentration of TCE. VOCs were detected in groundwater at greater concentrations south of Site 3 than north, and concentrations still greater were detected south of Site 1. With the exception of G24I, VOC contamination was greater in shallow than in intermediate wells. VOC contamination was also greater in subsurface than in surface soil. PCBs were detected at various locations in soil from all three sites. Recharge basin surface water and sediment exhibited trace to low levels of VOCs.

Notable levels of certain inorganics, including lead, arsenic, and cyanide, were detected in on-site media. Surface soil at Site 3 and subsurface soil at Site 2 exhibited the highest levels of inorganics. There is no clear pattern in the concentrations of inorganics in groundwater; notable levels of metals including arsenic, vanadium, chromium, lead and cyanide were reported in some wells.

192

3



0 200 400
SCALE IN FEET

FIGURE 4-22

GROUNDWATER INTERMEDIATE INORGANICS
(UNFILTERED)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

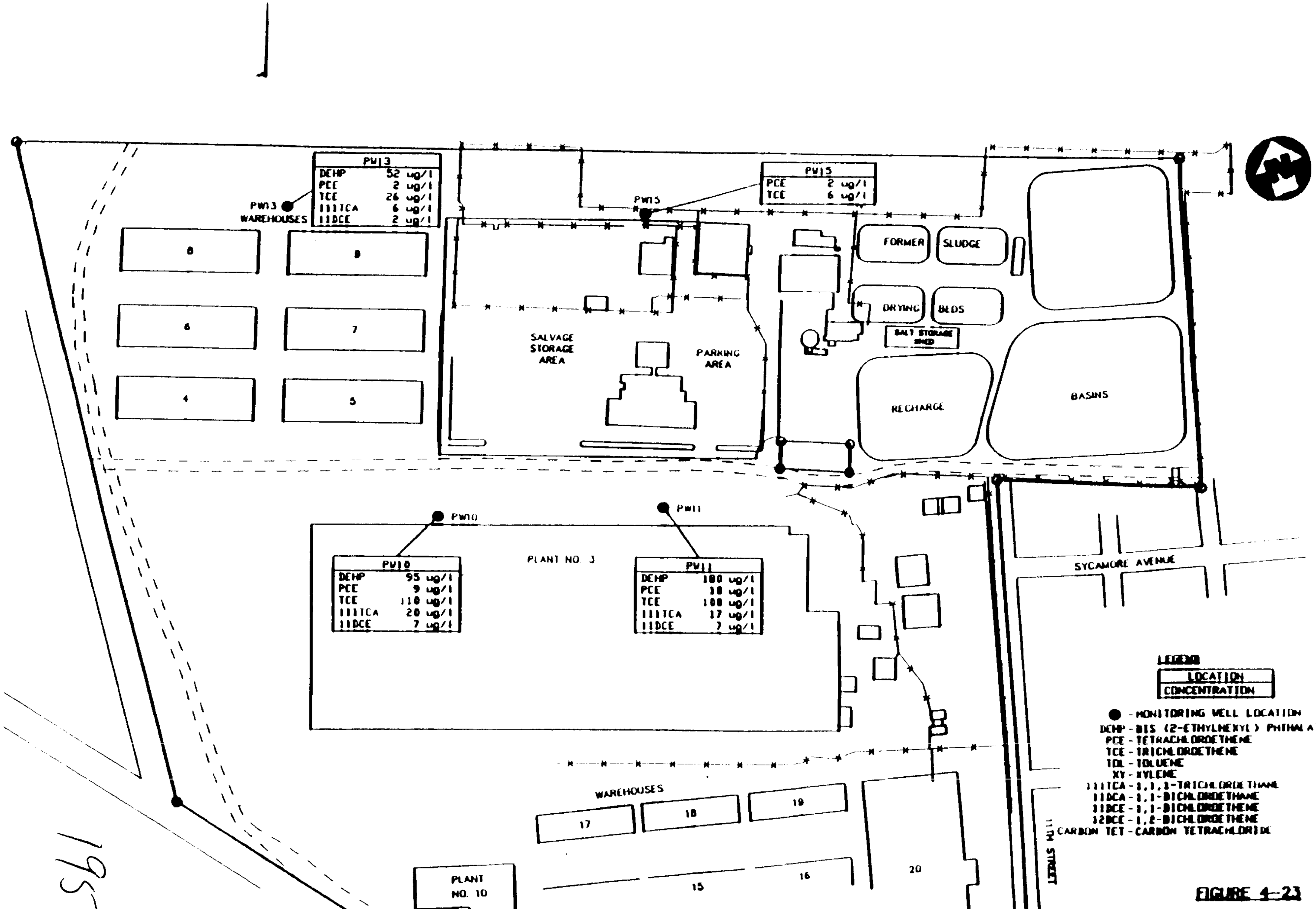


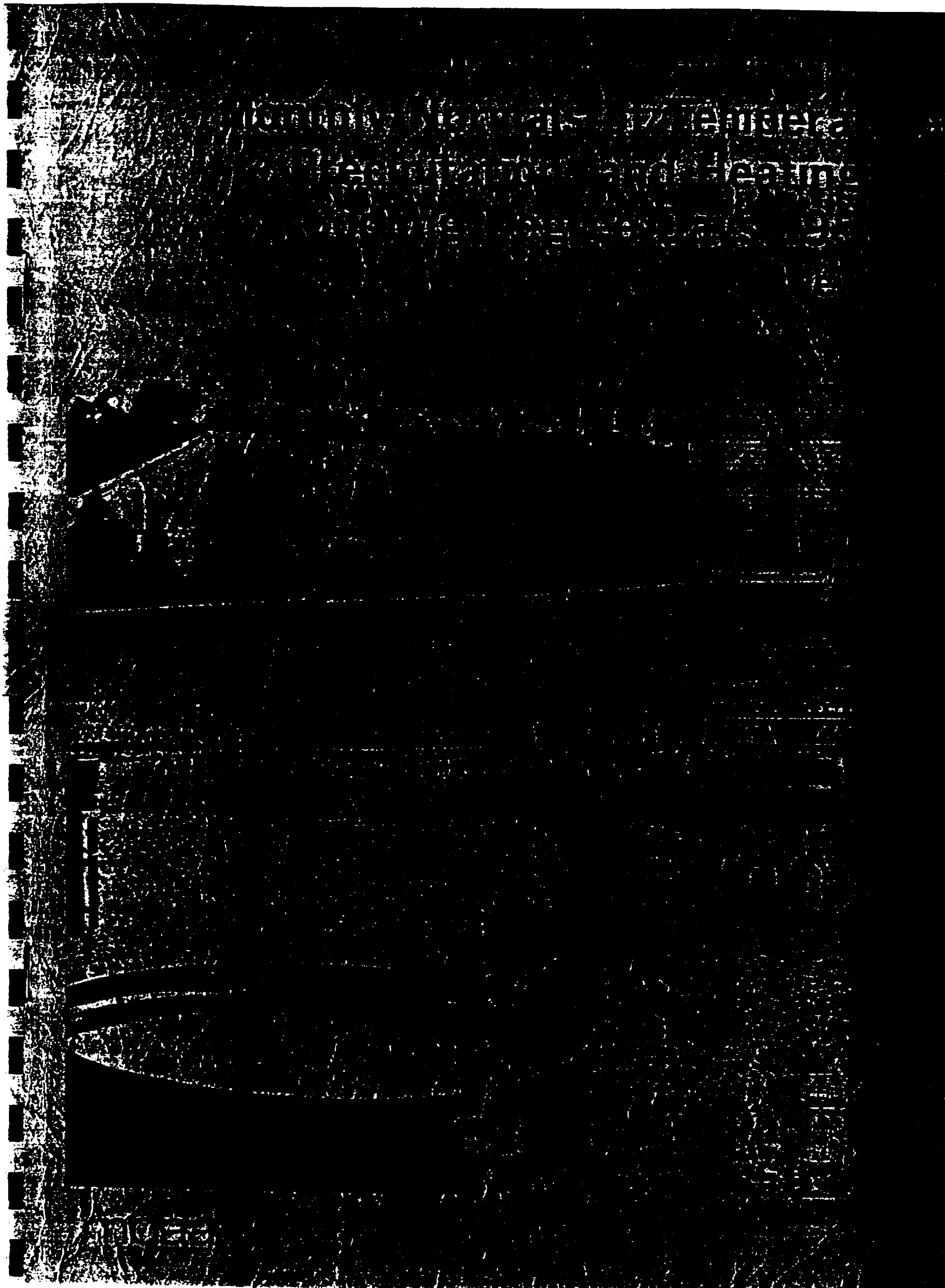
FIGURE 4-23

PRODUCTION WELLS ORGANICS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

195

REFERENCE NO. 3



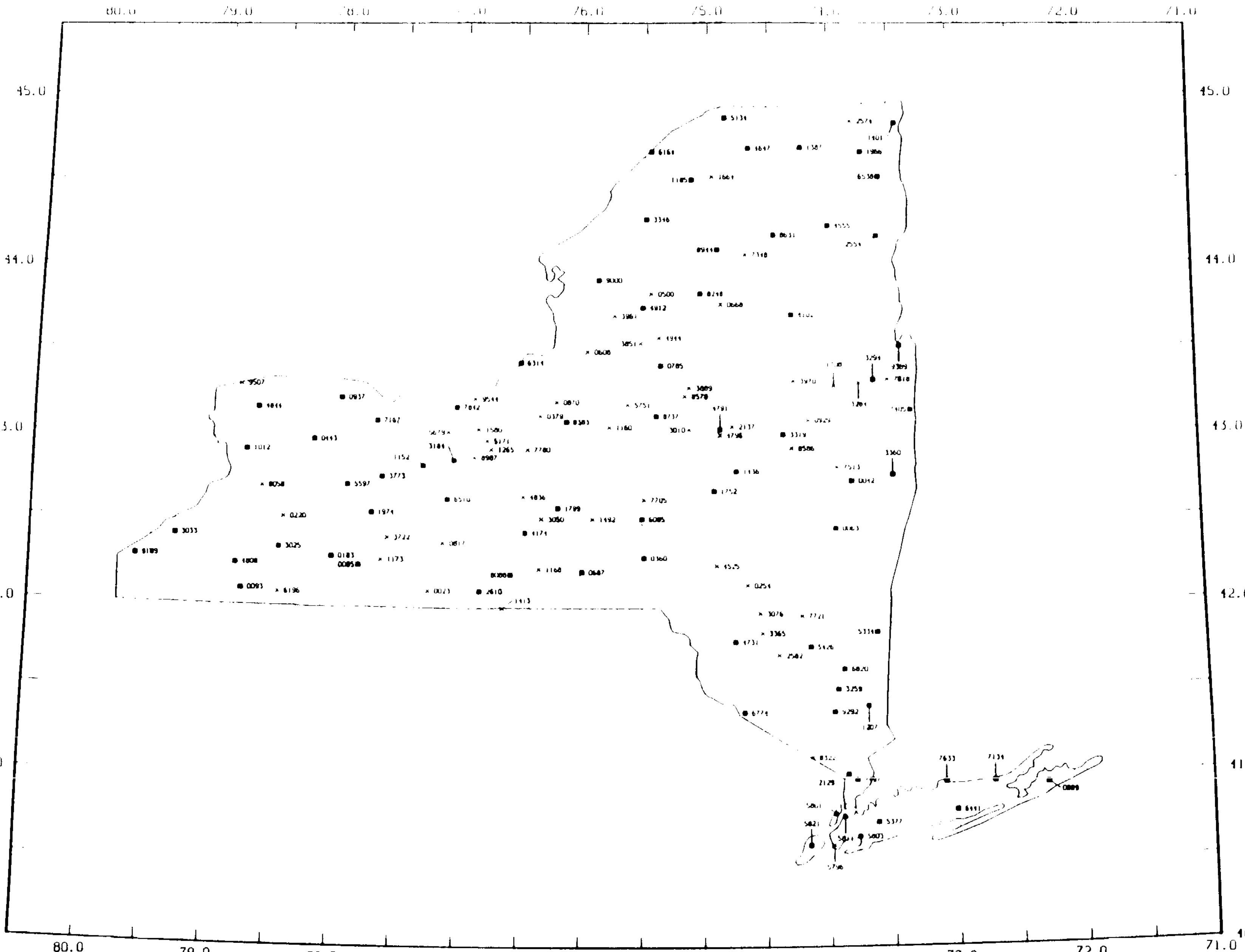
NEW YORK

PRECIPITATION NORMALS (INCHES)

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
GLENS FALLS FAA AP		2.51	2.36	3.09	3.10	3.05	3.14	3.00	3.14	3.03	2.96	2.97	2.96	35.21
GLOVERSVILLE		2.92	2.56	3.50	3.60	3.80	3.83	3.87	3.58	3.83	3.30	3.75	3.49	42.03
GOUVERNEUR		2.50	2.27	2.66	3.17	3.37	3.14	3.02	3.98	3.92	3.31	3.64	3.30	38.28
GRAFTON		2.77	2.39	3.29	3.71	4.17	4.68	4.00	4.19	4.03	3.54	3.92	3.29	43.98
GRAHAMSVILLE		3.24	2.87	3.69	3.96	3.85	4.06	4.37	4.24	3.86	3.86	3.99	3.78	45.77
HASKINVILLE		2.03	2.01	2.47	3.02	3.10	3.86	3.37	3.12	3.16	2.94	2.76	2.42	34.16
HEMLOCK		1.62	1.57	2.33	2.80	2.91	3.55	2.86	3.08	3.05	2.70	2.46	2.11	31.04
HIGHMARKET		3.97	3.35	3.59	4.24	4.71	4.40	4.21	4.79	5.37	4.72	5.15	4.37	52.87
HINCKLEY		3.64	3.20	4.03	4.08	4.47	4.29	4.26	4.39	4.66	3.89	4.47	4.25	49.63
HOOKER 4 N	//	5.71	4.12	4.05	4.15	4.12	3.91	4.20	4.20	4.90	4.69	5.74	5.54	55.33
HOPE		3.32	3.07	4.12	3.89	3.66	3.66	3.58	3.74	3.95	3.40	4.24	4.01	44.64
INDIAN LAKE 2 SW		2.79	2.54	3.21	2.93	3.29	3.40	3.44	3.85	3.91	3.20	3.85	3.32	39.73
ITHACA CORNELL UNIV.		2.08	2.08	2.57	2.80	3.05	3.73	3.54	3.38	3.38	3.09	2.97	2.60	35.27
LAKE DELAWARE		2.70	2.58	3.35	3.51	3.93	4.09	3.88	4.25	4.10	3.54	3.63	3.29	42.85
LAKE PLACID CLUB		2.63	2.37	2.86	2.93	3.18	3.54	3.79	4.16	3.61	2.99	3.23	3.04	38.39
LAWRENCEVILLE		1.69	1.87	2.01	2.65	3.03	3.32	3.47	4.02	3.45	3.05	2.56	2.21	33.33
LIBERTY		3.73	3.64	3.99	4.53	4.00	4.27	4.15	4.63	4.06	3.38	4.33	4.37	49.58
LITTLE FALLS CITY RES		2.72	2.48	2.90	3.69	3.79	4.05	4.01	3.79	4.19	3.23	3.79	3.30	41.94
LITTLE FALLS MILL ST		2.77	2.71	3.32	3.59	3.55	3.71	3.74	3.55	3.90	3.11	3.81	3.50	41.26
LITTLE VALLEY		3.94	3.40	3.92	4.13	3.75	4.36	3.65	4.21	4.39	3.79	4.76	4.74	49.04
LOCKE 2 W		2.03	2.09	2.72	3.10	3.21	4.12	3.36	3.45	3.53	3.30	3.26	2.95	37.12
LOCKPORT 2 NE		2.64	2.38	2.77	3.13	2.90	2.86	2.76	3.90	3.37	2.83	3.12	3.04	35.70
LOWVILLE		3.20	2.68	3.07	3.17	3.26	3.27	3.42	3.43	3.53	3.31	4.05	3.69	40.08
LYONS FALLS		3.67	3.12	3.35	3.54	3.67	3.69	3.69	3.95	4.20	3.52	4.24	4.18	44.82
MASSENA FAA AP		2.18	2.07	2.24	2.67	2.60	2.86	2.98	3.40	3.32	2.62	2.93	3.07	32.94
MAYS POINT LOCK 25		2.07	2.11	2.36	2.61	2.96	3.17	3.24	3.23	3.04	3.10	2.94	2.75	33.58
MILLBROOK		2.79	2.40	3.23	3.50	3.38	3.69	3.65	3.95	3.71	3.36	3.43	3.51	40.60
MINEOLA	R	3.31	3.37	4.44	4.01	3.46	2.93	3.17	4.06	3.63	3.38	3.97	3.92	43.65
MOHONK LAKE		3.47	3.22	4.07	4.34	4.06	3.70	4.00	4.16	4.14	4.03	4.11	4.04	47.34
MOUNT MORRIS 2 W		1.50	1.50	1.90	2.69	2.48	3.16	2.62	2.79	2.76	2.57	2.21	1.93	28.01
NEWARK		2.09	2.19	2.45	2.89	3.13	3.26	2.73	3.10	3.18	3.31	3.00	2.86	34.18
NEW LONDON LOCK 22		2.88	2.66	2.94	3.66	3.71	4.04	3.69	3.79	3.80	3.45	3.93	3.33	41.88
NEW YORK AVE V BRKLYN		3.15	3.22	4.21	3.35	3.72	3.23	4.17	4.45	3.95	3.24	3.86	3.68	44.73
NEW YORK CNTRL PK WSO		3.21	3.13	4.22	3.75	3.76	3.23	3.77	4.03	3.66	3.41	4.14	3.81	44.12
NEW YORK JFK INTL AP		2.93	3.20	3.99	3.76	3.40	2.98	3.56	4.10	3.51	2.98	3.73	3.62	41.76
NEW YORK LA GUARDIA WSO		3.11	3.08	4.10	3.76	3.46	3.15	3.67	4.32	3.48	3.24	3.77	3.68	42.82
NY WESTERLEIGH STAT IS		3.31	3.35	4.39	3.89	3.73	3.23	4.56	4.96	3.99	3.51	3.99	3.83	46.74
NORWICH 1 NE		2.66	2.41	3.20	3.45	3.55	4.16	3.67	3.17	3.77	3.15	3.67	3.42	40.28
OGDENSBURG 3 NE		2.06	1.80	2.05	2.72	2.65	2.97	3.10	3.60	3.29	2.89	2.80	2.74	32.67
OLEAN		2.29	2.03	2.99	3.27	3.29	3.88	3.50	3.38	3.63	2.92	3.01	2.79	36.98
OSWEGO EAST	//	3.24	3.02	2.91	3.28	3.07	3.19	2.65	3.09	3.51	3.51	4.02	3.81	39.30
PATCHOGUE 2 N		3.78	3.62	4.33	3.95	3.66	2.94	3.31	4.49	3.36	3.85	4.01	4.41	45.71
PENN YAN 2 SW		1.82	1.90	2.43	2.57	2.86	3.06	2.86	3.02	2.72	2.93	2.71	2.28	31.16
PERU 2 WSW		1.65	1.58	1.93	2.40	2.52	3.00	2.99	3.07	2.69	2.67	2.42	2.00	28.92
PORT JERVIS		3.17	2.69	3.75	3.78	3.64	3.58	4.08	4.06	3.54	3.39	3.85	3.48	43.01
POUGHKEEPSIE FAA AP		2.75	2.42	3.28	3.66	3.62	3.43	3.50	3.77	3.66	3.30	3.57	3.20	40.16
RIVERHEAD RESEARCH		4.07	3.63	4.28	3.74	3.53	2.90	3.20	4.17	3.60	3.56	4.18	4.46	45.32
ROCHESTER WSO	//R	2.30	2.32	2.53	2.64	2.58	2.78	2.48	3.20	2.66	2.54	2.65	2.59	31.27
SABATTIS 3 NE		2.78	2.56	2.95	3.32	3.68	3.68	3.92	4.26	3.84	3.42	3.63	3.71	41.75
SALEM		2.79	2.29	2.98	3.32	3.58	3.84	3.53	3.56	3.78	3.13	3.24	3.08	39.22
SCARSDALE		3.40	3.27	4.63	4.13	3.80	3.39	4.02	4.55	3.96	3.71	4.46	4.10	47.42
SCHENECTADY		2.48	2.27	2.98	3.02	3.34	3.42	3.03	3.30	2.95	2.98	3.04	2.81	35.62
SETAUKET		3.62	3.35	4.35	3.92	3.52	3.02	3.26	4.02	3.77	3.62	4.14	4.30	44.89
SHERBURNE 2 S		2.29	2.13	2.81	3.02	3.11	3.59	3.42	3.33	3.50	3.05	3.14	2.76	36.15
SHOKAN BROWN STATION		3.52	3.17	4.20	4.33	4.06	3.76	4.05	3.85	4.16	4.26	4.51	4.30	48.17

30 – NEW YORK

LEGEND
○ = TEMPERATURE ONLY
× = PRECIPITATION ONLY
⊗ = TEMPERATURE & PRECIPITATION



30 - NEW YORK

LEGEND
11 = TEMPERATURE ONLY
12 = PRECIPITATION ONLY
13 = TEMP. & PRECIP.

STATE-STATION NUMBER	STN TYP	NAME	LATITUDE DEG-MIN	LONGITUDE DEG-MIN	ELEVATION (FT)
30-3050	12	FREEVILLE 2 NE	N 4232	W 07619	1080
30-3076	12	FROST VALLEY	N 4158	W 07433	1840
30-3184	13	GENEVA RESEARCH FARM	N 4253	W 07702	718
30-3259	13	GLENHAM	N 4131	W 07356	275
30-3284	12	GLENS FALLS FARM	N 4320	W 07344	504
30-3294	13	GLENS FALLS FAA AP	N 4321	W 07337	321
30-3319	13	GLOVERSVILLE	N 4302	W 07421	760
30-3346	13	GOUVERNEUR	N 4420	W 07529	460
30-3360	13	GRAFTON	N 4247	W 07328	1560
30-3365	12	GRAHAMSVILLE	N 4151	W 07432	960
30-3722	12	HASKINVILLE	N 4225	W 07734	1640
30-3773	13	HEMLOCK	N 4247	W 07737	902
30-3851	12	HIGHMARKET	N 4335	W 07531	1790
30-3889	12	HINCKLEY	N 4319	W 07507	1190
30-3961	12	HOOKER 4 N	N 4345	W 07544	1680
30-3970	12	HOPE	N 4321	W 07416	950
30-4102	13	INDIAN LAKE 2 SW	N 4345	W 07417	1660
30-4174	13	ITHACA CORNELL UNIV	N 4227	W 07627	960
30-4525	12	LAKE DELAWARE	N 4215	W 07454	1480
30-4555	13	LAKE PLACID CLUB	N 4417	W 07359	1880
30-4647	13	LAWRENCEVILLE	N 4445	W 07439	500
30-4731	13	LIBERTY	N 4148	W 07445	1610
30-4791	13	LITTLE FALLS CITY RES	N 4304	W 07452	900
30-4796	12	LITTLE FALLS MILL ST	N 4302	W 07452	360
30-4808	13	LITTLE VALLEY	N 4215	W 07848	1575
30-4836	12	LOCKE 2 W	N 4240	W 07628	1180
30-4844	13	LOCKPORT 2 NE	N 4311	W 07839	520
30-4912	13	LOWVILLE	N 4348	W 07530	960
30-4944	12	LYONS FALLS	N 4337	W 07522	800
30-5134	13	MASSENA FAA AP	N 4456	W 07451	214
30-5171	12	MAYS POINT LOCK 25	N 4300	W 07646	400
30-5334	13	MILLBROOK	N 4151	W 07337	815
30-5377	13	MINEOLA	N 4044	W 07338	128
30-5426	13	MOHONK LAKE	N 4146	W 07409	1245
30-5597	13	MOUNT MORRIS 2 W	N 4244	W 07754	880
30-5679	12	NEWARK	N 4303	W 07705	430
30-5751	12	NEW LONDON LOCK 22	N 4313	W 07537	400
30-5796	12	NEW YORK AVE V BRKLYN	N 4036	W 07359	15
30-5801	13	NEW YORK CNTRL PK WSO	N 4047	W 07358	132
30-5803	13	NEW YORK JFK INTL AP	N 4039	W 07347	13
30-5811	13	NEW YORK LA GUARDIA WSO	N 4046	W 07354	11
30-5821	13	NY WESTERLEIGH STAT IS	N 4036	W 07410	80
30-6085	13	NORWICH 1 NE	N 4232	W 07530	1120
30-6164	13	OGDENSBURG 3 NE	N 4444	W 07527	285
30-6196	12	OLEAN	N 4205	W 07827	1420
30-6314	13	OSWEGO EAST	N 4328	W 07630	350
30-6441	13	PATCHOGUE 2 N	N 4048	W 07301	55
30-6510	13	PENN YAN 2 SW	N 4239	W 07705	720
30-6538	13	PERU 2 WSW	N 4434	W 07334	510
30-6774	13	PORT JERVIS	N 4123	W 07441	470

REFERENCE NO. 4

CLIMATOGRAPHY OF THE UNITED STATES NO. 20

MINEOLA, NY

PERIOD: 1951-80
ELEVATION: 128 FT

CLIMATOLOGICAL SUMMARY

TEMPERATURE (F)

	MEAN			EXTREMES						MEAN NUMBER OF DAYS				DEGREE DAYS	
	DAILY MAXIMUM*	DAILY MINIMUM*	MONTHLY*	RECORD HIGHEST	YEAR	DAY	RECORD LOWEST	YEAR	DAY	MAX 90 AND ABOVE	MAX 32 AND BELOW	MIN 32 AND BELOW	MIN 0 AND BELOW	HEATING BASE 65*	COOLING BASE 65*
JAN	37.3	25.5	31.4	64+	74	27	1+	76	23	0	10	24	0	1042	0
FEB	38.7	26.1	32.4	68+	76	28	-1+	61	2	0	7	21	0	913	0
MAR	46.4	33.1	39.8	75+	77	30	5+	80	1	0	1	14	0	781	0
APR	58.0	41.8	49.9	92+	76	17	25+	76	[illegible]	0	0	2	0	453	0
MAY	68.3	51.2	59.7	96+	75	24	36+	77	9	0	0	0	0	193	29
JUN	77.5	60.5	69.1	101	52	26	44	74	28	2	0	0	0	24	147
JUL	82.8	66.4	74.6	103+	66	3	50+	79	5	4	0	0	0	0	301
AUG	81.5	65.5	73.5	102+	75	2	46+	76	31	3	0	0	0	0	266
SEP	74.2	58.7	66.5	97+	53	2	40+	80	26	1	0	0	0	56	101
OCT	63.7	48.5	56.1	88	67	5	27+	76	28	0	0	0	0	291	15
NOV	52.3	39.8	46.1	77+	75	9	19+	76	30	0	0	5	0	567	0
DEC	41.4	29.8	35.7	66+	62	1	3+	80	25	0	5	19	0	908	0
YEAR	60.2	45.6	52.9	103	JUL 66	3	-1	FEB 61	2	10	23	85	0	5228	859

PRECIPITATION TOTALS (INCHES)

	MEAN	GREATEST MONTHLY	YEAR	GREATEST DAILY	YEAR	DAY	SNOW MEAN	SNOW MAXIMUM MONTHLY	YEAR	MEAN NUMBER OF DAYS .10 OR MORE	.50 OR MORE	1.00 OR MORE
JAN	3.31	9.84	79	3.09	79	21	7.4	20.7	65	6	2	0
FEB	3.37	5.48	56	2.22	66	13	8.6	28.0	67	6	2	1
MAR	4.44	9.28	80	3.23	79	06	5.4	24.5	67	8	3	1
APR	4.01	8.28	80	3.72	80	09	.4	4.0	56	6	3	1
MAY	3.46	7.34	78	2.58	68	29	0	0		6	2	1
JUN	2.93	8.73	75	2.95	75	12	.0	.0		5	2	1
JUL	3.17	9.26	69	3.15	69	28	.0	.0		5	2	1
AUG	4.06	15.60	55	8.20	55	12	0	.0		6	2	1
SEP	3.63	9.19	75	4.99	60	12	0	0		5	2	1
OCT	3.38	7.36	77	4.90	72	07	.1	1.4	62	5	2	1
NOV	3.97	10.07	72	4.09	77	08	.5	4.0	53	6	2	1
DEC	3.92	8.99	73	2.44	74	16	4.3	16.0	60	7	3	1
YEAR	43.65	15.60	AUG 55	8.20	AUG 55	12	26.7	28.0	FEB 67	71	27	11

*FROM 1951 80 NORMALS

ESTIMATED VALUE BASED ON DATA FROM SURROUNDING STATIONS

+ ALSO ON EARLIER DATES

DEGREE DAYS TO SELECTED BASE TEMPERATURES (F)

HEATING DEGREE DAYS

BASE BELOW	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
65	1042	913	781	453	193	24	0	0	56	291	567	908	5228
60	887	773	626	306	98	0	0	0	13	171	417	753	4044
57	794	689	533	222	55	0	0	0	0	118	327	660	3398
55	732	633	471	171	34	0	0	0	0	87	273	598	2999
50	577	493	322	75	9	0	0	0	0	30	146	451	2103

COOLING DEGREE DAYS

BASE ABOVE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
55	0	0	0	18	179	423	608	574	345	121	6	0	2274
57	0	0	0	9	139	363	546	512	290	90	0	0	1949
60	0	0	0	0	89	277	453	419	208	50	0	0	1496
65	0	0	0	0	29	147	301	266	101	15	0	0	859
70	0	0	0	0	7	60	161	129	33	0	0	0	390

DERIVED FROM THE 1951 80 MONTHLY NORMALS

PROBABILITY THAT THE MONTHLY PRECIPITATION WILL BE EQUAL TO OR LESS THAN THE INDICATED PRECIPITATION AMOUNT

MONTHLY PRECIPITATION (INCHES)

PROBABILITY LEVELS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
.05	.72	1.45	1.95	1.62	1.00	.74	.55	.78	.85	.77	.94	1.05
.10	1.03	1.75	2.35	1.99	1.33	1.02	.82	1.14	1.18	1.08	1.31	1.42
.20	1.51	2.18	2.90	2.51	1.82	1.44	1.29	1.74	1.72	1.58	1.89	1.99
.30	1.95	2.53	3.35	2.94	2.25	1.82	1.72	2.29	2.19	2.02	2.41	2.49
.40	2.39	2.85	3.78	3.35	2.67	2.19	2.17	2.85	2.67	2.47	2.93	2.98
.50	2.86	3.18	4.20	3.76	3.10	2.59	2.65	3.44	3.17	2.94	3.47	3.49
.60	3.39	3.54	4.66	4.20	3.59	3.02	3.20	4.12	3.73	3.47	4.08	4.06
.70	4.02	3.94	5.18	4.72	4.15	3.54	3.87	4.95	4.41	4.10	4.81	4.73
.80	4.85	4.46	5.84	5.37	4.89	4.22	4.76	6.03	5.29	4.93	5.77	5.61
.90	6.17	5.24	6.84	6.36	6.04	5.30	6.20	7.78	6.69	6.26	7.28	6.98
.95	7.43	5.95	7.74	7.26	7.11	6.30	7.58	9.44	8.01	7.50	8.71	8.27

THESE VALUES WERE DETERMINED FROM THE INCOMPLETE GAMMA DISTRIBUTION.

202

305377 MINEOLA, NY

LAT: 40 44N (DEG MIN) LONG: 73 38W (DEG MIN)

PERIOD: 1951-80

FREEZE DATA

PROBABILITY OF LATER DATE IN SPRING (THRU JULY 31) THAN INDICATED(*)

SPRING FREEZE DATES (MO/DAY)

TEMP (F)	.90	.80	.70	.60	.50	.40	.30	.20	.10
36	4/05	4/09	4/12	4/15	4/18	4/20	4/23	4/26	5/01
32	3/25	3/29	4/01	4/03	4/06	4/08	4/10	4/13	4/17
28	3/11	3/16	3/20	3/23	3/27	3/30	4/02	4/06	4/11
24	2/25	3/02	3/07	3/10	3/14	3/17	3/21	3/25	3/31
20	2/07	2/14	2/19	2/24	2/28	3/04	3/08	3/13	3/20
16	1/26	2/02	2/07	2/12	2/16	2/20	[illegible]	[illegible]	[illegible]

PROBABILITY OF EARLIER DATE IN FALL (BEGINNING AUG 1) THAN INDICATED(*)

FALL FREEZE DATES (MO/DAY)

TEMP (F)	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	10/15	10/20	10/23	10/26	10/29	11/01	11/03	11/07	11/11
32	10/26	10/31	11/04	11/07	11/10	11/13	11/16	11/20	11/25
28	11/07	11/13	11/17	11/21	11/24	11/27	11/30	12/04	12/10
24	11/23	11/28	12/01	12/04	12/07	12/09	12/12	12/15	12/20
20	12/03	12/07	12/11	12/14	12/16	12/19	12/22	12/25	12/30
16	12/09	12/16	12/21	12/26	12/30	1/03	1/07	1/11	1/20

PROBABILITY OF LONGER THAN INDICATED FREEZE FREE PERIOD (DAYS)

FREEZE FREE PERIOD

TEMP (F)	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	212	205	201	197	194	190	186	182	176
32	238	231	226	222	218	214	209	204	197
28	266	258	251	246	241	237	231	225	217
24	292	283	277	272	267	263	257	251	243
20	315	306	301	296	291	286	281	275	267
16	347	336	329	322	316	310	304	[illegible]	286

(*) PROBABILITY OF OBSERVING A TEMPERATURE AS COLD, OR COLDER, LATER IN THE SPRING OR EARLIER IN THE FALL THAN THE INDICATED DATE

0/00 INDICATES THAT THE PROBABILITY OF OCCURRENCE OF [illegible] TEMPERATURE IS LESS THAN INDICATED PROBABILITY

GROWING DEGREE UNITS TO SELECTED BASE TEMPERATURES (F)

BASE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
40	M	21	23	[illegible]	310	622	879	1082	1047	802	509	215	51	[illegible]
	S	21	44	131	441	1063	1942	3024	4071	4873	5382	5597	5648	
45	M	5	6	32	181	467	729	927	892	652	359	112	18	[illegible]
	S	5	11	43	224	691	1420	2347	3239	3891	4250	4362	4380	
50	M	1	1	8	83	317	579	772	737	502	223	46	4	[illegible]
	S	1	2	10	93	416	995	1767	2504	3006	3229	3275	3279	
55	M	0	0	1	37	185	429	617	582	354	115	14	0	[illegible]
	S	0	0	1	38	223	652	1269	1851	2205	2420	2334	2334	
60	M	0	0	0	13	87	283	462	427	219	47	4	0	[illegible]
	S	0	0	0	13	100	383	845	1272	1491	1538	1542	1542	

M - MONTHLY DATA S - SUM OF MONTHLY DATA

GROWING DEGREE UNITS FOR CORN

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
CORN	M	6	8	32	142	340	570	753	724	503	259	81	15	3433
	S	6	14	46	188	528	1098	1851	2575	3078	3337	3418	3433	

NOTE: FOR CORN THE BASE IS 50, AND THE DEGREE UNITS ARE ADJUSTED FOR TEMPERATURES BELOW 50 AND ABOVE 86

OTHER CLIMATOLOGICAL DATA ARE AVAILABLE IN A VARIETY OF SUMMARIES AND FORMATS, SUCH AS THE CLIMATOGRAPHY OF THE UNITED STATES: NO. 60 CLIMATE OF STATES; NO. 81 - MONTHLY NORMALS (AND SUPPLEMENTS: ANNUAL DEGREE DAYS TO SELECTED BASES DERIVED FROM THE 1951-80 NORMALS; AND MONTHLY PRECIPITATION PROBABILITIES, SELECTED PROBABILITY LEVELS DERIVED FROM THE 1951-80 NORMALS); NO. 84 DAILY NORMALS; NO. 85 DIVISIONAL NORMALS. A VARIETY OF DATA IS AVAILABLE EITHER ON MAGNETIC TAPE, MICROFICHE, OR PAPER COPY.

TO OBTAIN INFORMATION ABOUT CLIMATOLOGICAL DATA AND RELATED PUBLICATIONS, CONTACT:

DIRECTOR
NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NC 28801-2696
[illegible] TELEPHONE: [illegible]

DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
[illegible] SATELLITE, DATA, AND INFORMATION SERVICE
[illegible] CLIMATIC DATA CENTER
ASHEVILLE, NC

[illegible]

263

REFERENCE NO. 5

204

. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

TECHNICAL PAPER NO. 40

RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

205

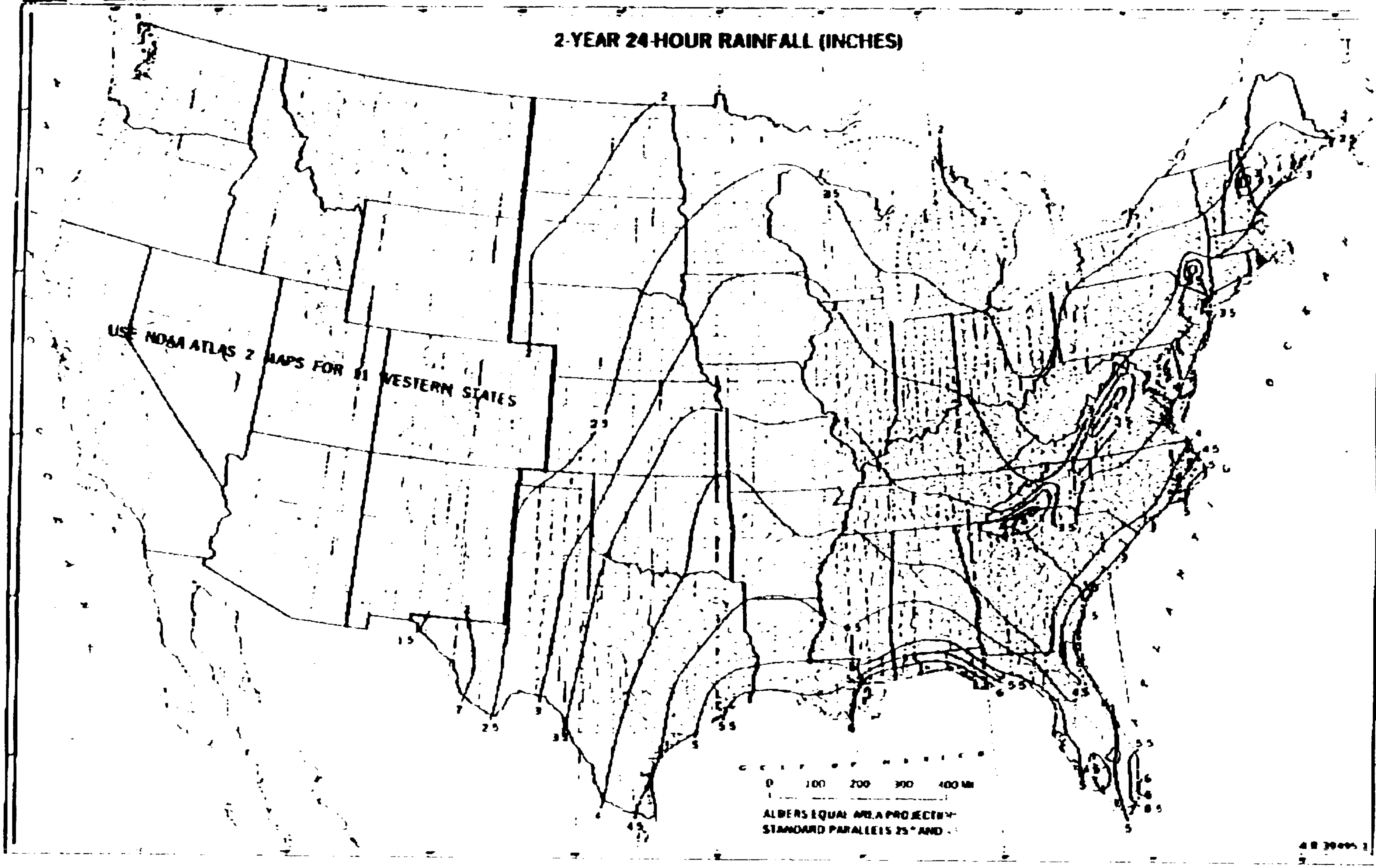


Figure B-3.—Two-year, 24-hour rainfall.

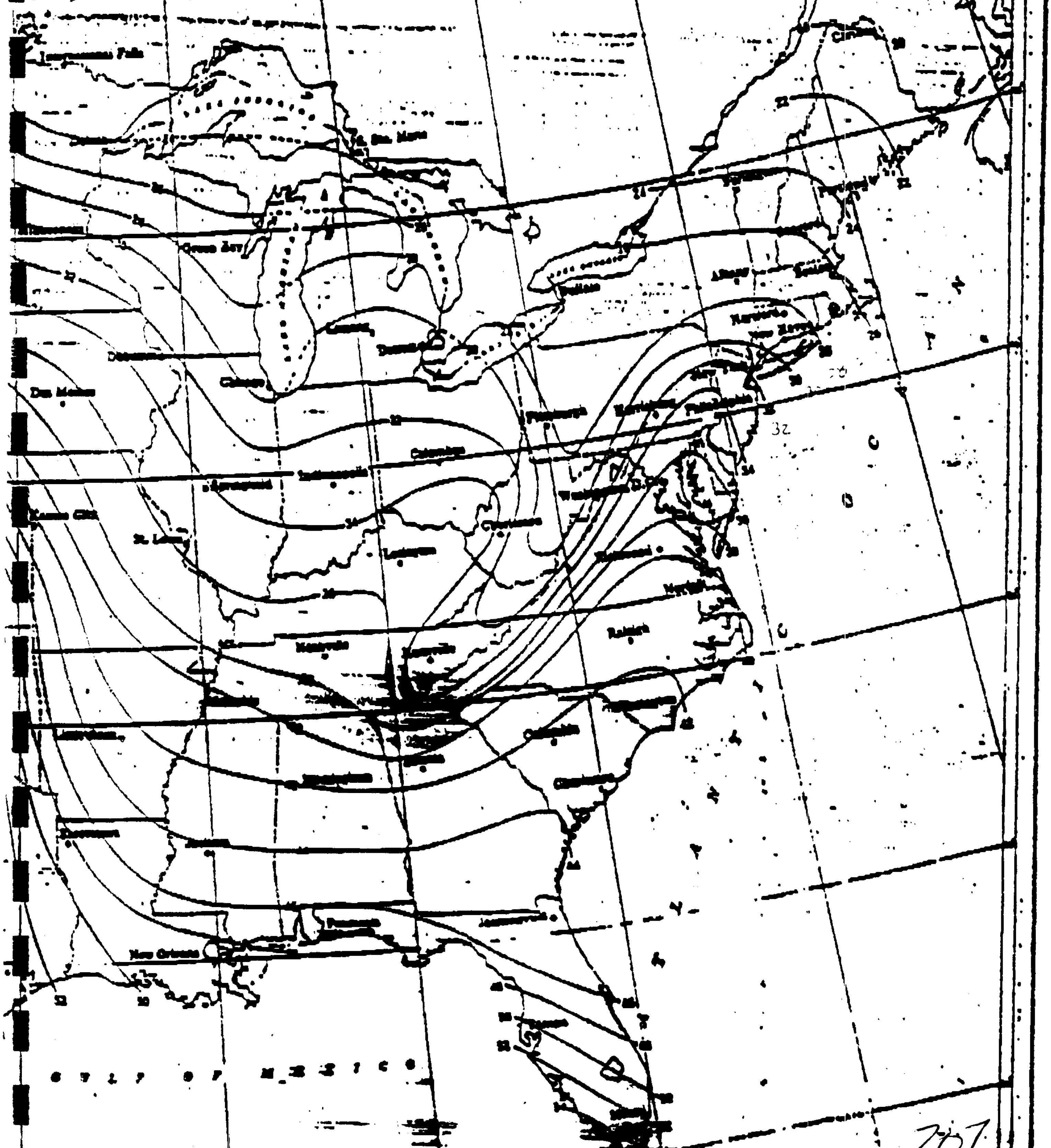
206

SENT BY:NUS WAYNE PA FIT ;10-15-91 3:06PM ; 2156879510→ 2159719715;# 4

LAKE EVAPORATION UNITED STATES*

EVAPORATION

es)



Based on period 1946-55

207

REFERENCE NO. 6

BETHPAGE HRS

The Bethpage Water District supplies 33,000 residents with drinking water obtained from nine wells located within a four-mile radius from the site. The 1991 apportioned population is 16,929 residents supplied from four wells located within 1/2 to one mile, and 16,071 residents supplied by five wells located within one to two miles.

The Levittown Water District supplies 50,000 residents with drinking water obtained from nine wells located within a four-mile radius of the site. The 1990 apportioned population is 42,600 residents supplied from seven wells located within two to three miles and 7,400 residents supplied by two wells located within three to four miles.

The East Meadow Water District supplies a total of 50,000 residents from 10 wells. Two of these wells are located within a three- to four-mile radius of the site; the 1990 apportioned service population is 7,862.

The Bowling Green Water District supplies 12,000 residents from two wells located within a three- to four-mile radius of the site.

The Plainview Water District supplies 35,000 residents with drinking water obtained from 10 wells located within a four-mile radius of the site. The 1990 apportioned population is 10,989 residents supplied by four wells located within one to two miles and 24,011 supplied by five wells located within two to three miles.

Farmingdale Village supplies 8,446 residents with drinking water obtained from three wells located within a four-mile radius of the site. The 1990 apportioned population is 5,355 residents supplied by two wells located within a two- to three-mile radius, and 3,091 residents supplied by one well located within three to four miles.

The South Farmingdale Water District supplies 44,700 residents with drinking water obtained from 11 wells. Nine of these wells are located within a four-mile radius of the site; the 1990 apportioned service population is 25,747 residents supplied by six wells located within a two- to three-mile radius and 17,478 residents supplied by three wells within a three- to four-mile radius.

The Hicksville Water District supplies 47,810 residents with drinking water obtained from 12 wells located within a four-mile radius of the site. The 1990 apportioned population is 20,114 residents supplied by four wells located within a two- to three-mile radius and 27,700 residents supplied by eight wells located within a three- to four-mile radius.

The New York Water Service - Merrick Division serves 170,346 residents with drinking water obtained from 17 wells. Two of these wells are located within a three- to four-mile radius of the site; the 1990 apportioned population is 35,301.

The Jericho Water District supplies 58,000 residents with drinking water obtained from 20 wells. Four of these wells are located within a three- to four-mile radius of the site; the 1990 apportioned service population is 16,794.

The Westbury Water District supplies 20,050 residents with drinking water obtained from 10 wells. One of these wells is located within a three- to four-mile radius of the site; the 1990 apportioned service population is 38.

The South Huntington Water District supplies 55,000 residents with drinking water obtained from four wells. Three of these wells are located within a three- to four-mile radius of the site. The 1990 apportioned service population is 11,935.

The East Farmingdale Water District supplies 5,700 residents with drinking water obtained from four wells. Two of these wells are located within a three- to four-mile radius of the site. The 1991 apportioned service population is 1,345.

No private home wells are known to exist within a four-mile radius.

BETHPAGE FOUR-MILE-RADIUS
APPORTIONED WATER SUPPLY SUMMARY

Water Company	Population					
	0 to 1/4 mile	1/4 to 1/2 mile	1/2 to 1 mile	1 to 2 miles	2 to 3 miles	3 to 4 miles
Bethpage Water Department	0	0	16,929	16,071	0	0
Levittown Water Department	0	0	0	0	42,600	7,400
Plainview Water Department	0	0	0	10,989	24,011	0
Hicksville Water Department	0	0	0	20,114	27,700	0
East Meadow Water Department	0	0	0	0	0	7,862
Bowling Green Water Department	0	0	0	0	0	12,000
South Farmingdale Water Department	0	0	0	0	25,747	17,478
Farmingdale Village	0	0	0	0	5,355	3,091
New York Water - Merrick	0	0	0	0	0	35,301
Westbury Water Department	0	0	0	0	0	38
Jericho Water Department	0	0	0	0	0	16,794
South Huntingdon Water Department	0	0	0	0	0	11,935
East Farmingdale Water Department	0	0	0	0	0	1,345
Home Wells	0	0	0	0	0	0
TOTALS	**0**	**0**	**16,929**	**47,174**	**125,413**	**113,244**

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Bethpage Water Department Population: 33,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
3876	1 to 2	386	154,286	11.6	3,828
8941	1 to 2	770	111,729	8.4	2,772
8004	1 to 2	740	99,281	7.5	2,475
6915	1 to 2	608	183,553	13.8	4,554
6916	1 to 2	611	98,020	7.4	2,442
6078	1/2 to 1	275	39	0.003	---
8767	1/2 to 1	640	292,760	22.0	7,260
8768	1/2 to 1	678	374,573	28.2	9,306
9591	1/2 to 1	607	14,881	1.1	363
			1,329,122 X 1,000 gallons (1991)		

1/2- to 1-mile population: 16,929

1- to 2-mile population: 16,071

Superintendent: Ronald Krumholz

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Levittown Water Department   Population: 50,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
4450	2 to 3	466	357,323,900	21.7	10,850
8321	2 to 3	674	70,934,400	4.3	2,150
7076	2 to 3	674	307,406,500	18.7	9,350
3618	2 to 3	418	56,980,500	3.5	1,750
8279	2 to 3	547	184,848,000	11.2	5,600
7523	2 to 3	684	170,635,300	10.4	5,200
5302	3 to 4	484	243,625,300	14.8	7,400
5303	2 to 3	512	252,523,600	15.4	7,700
5304	3 to 4	467	286,600	less than 0.1	---
5301	2 to 3	377	---	---	---
2580	2 to 3	357	---	---	---
4451	2 to 3	403	---	---	---
			1,644,024,100 gallons (1990)		

2- to 3-mile population: 42,600

3- to 4-mile population: 7,400

Superintendent: Harold Morgan

213

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Plainview Water Department Population: 35,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
4097	1 to 2	465	12,502	less than 0.1	278
6076	1 to 2	358	53,295	0.3	1,183
6077	1 to 2	460	251,718	16.0	5,588
6580	1 to 2	496	177,473	11.3	3,490
8595	2 to 3	610	102,526	6.5	2,276
8054	2 to 3	580	214,083	13.6	4,753
6956	2 to 3	597	245,156	15.6	5,443
7421	2 to 3	559	162,164	10.2	3,600
4095	2 to 3	490	---	0	0
4096	2 to 3	494	248,118	15.7	5,508
7526	2 to 3	688	109,479	6.9	2,431
			1,576,517	X 1,000 gallons (1990)	

1- to 2-mile population: 10,989

2- to 3-mile population: 24,011

Superintendent: Kenneth Claus

214

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Hicksville Water Department   Population: 47,810

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
8525	1 to 2	503	---	---	---
6192	1 to 2	626	---	---	---
6193	1 to 2	467	---	---	---
9180	1 to 2	630	---	---	---
8778	1 to 2	590	277,482	11.9	5,680
8779	1 to 2	585	75,026	3.2	1,534
10208	1 to 2	649	525,134	22.5	10,739
10555	1 to 2		105,662	4.5	2,161
5336	2 to 3	523	---	---	---
8526	2 to 3	601	---	---	---
9212	2 to 3	604	199,377	8.5	4,077
7561	2 to 3	550	267,158	11.4	5,463
6190	2 to 3	600	---	---	---
6191	2 to 3	550	---	---	---
7562	2 to 3	545	7,280	0.3	149
8249	2 to 3	490	114	---	---
9488	2 to 3	575	560,369	24.0	11,460
9463	2 to 3	638	268,746	11.5	5,496
3878	2 to 3	428	46,536	2.0	952
3953	2 to 3	419	5,017	0.2	103
			2,337,901	X 1,000 gallons (1990)	

1- to 2-mile population: 20,114

2- to 3 mile population: 27,700

Superintendent: Richard Woodwell

215

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: East Meadow Water Department — Population: 50,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
5321	3 to 4	509	109,641,700	4.8	2,386
5322	3 to 4	510	251,665,700	11.0	5,476
4447	greater than 4	330	3,300		
4448	greater than 4	550	312,184,900		
3465	greater than 4	580	376,235,000		
3457	greater than 4	320	800		
7797	greater than 4	545	599,783,400		
3456	greater than 4	555	25,694,300		
5318	greater than 4	663	155,011,200		
5319	greater than 4	438	---		
5320	greater than 4	643	467,554,600		
			2,297,777,900 gallons (1990)		

3- to 4-mile population: 7,862

Superintendent: Harold Morgan

216

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Bowling Green Water Department   Population: 12,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
8956	3 to 4	530	161,729,500	90	10,800
8957	3 to 4	584	17,993,700	10	1,200
179,723,200 gallons (1990)					

3- to 4-mile population: 12,000

Superintendent: Harold Morgan

217

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: South Farmingdale Water Department Population: 44,700

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
4043	2 to 3	374	138,690,423	9.3	4,157
7377	2 to 3	758	198,133,451	13.3	5,945
5148	2 to 3	369	1,521,763	0.1	45
6150	2 to 3	607	26,037,150	17.6	7,867
7515	2 to 3	347	128,142,681	8.6	3,844
7516	2 to 3	584	129,611,234	8.7	3,889
8664	3 to 4	606	146,411,780	9.9	4,425
8665	3 to 4	576	126,840,776	8.5	3,800
6148	3 to 4	561	307,381,248	20.7	9,253
6149	greater than 4	640	23,840,020	1.6	715
5147	greater than 4	219	23,915,915	1.6	715
			1,485,526,441	gallons (1991)	

2- to 3-mile population: 25,747

2- to 4-mile population: 17,478

Superintendent: Al Licci

218

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Farmingdale Village Population: 8,446

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
6644	2 to 3	227	63,154	16.3	1,377
7852	3 to 4	457	141,895	36.6	3091
11004	2 to 3	480	183,154	47.1	3,978
			388,203	X 1,000 gallons (1990)	

2- to 3-mile population: 5,355

3- to 4-mile population: 3,091

Superintendent: Jack Scherer

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: New York Water Service - Merrick   Population: 170,346

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
3893	3 to 4	151	0	0	
8480	3 to 4	656	351,900	6.7	11,384
9338	3 to 4	649	739,300	14.0	23,917
5767	greater than 4	384	93,100	1.8	3,012
8837	greater than 4	681	21,700		
9910	greater than 4	774	510,440		
10195	greater than 4	585	653,450		
9514	greater than 4	660	353,610		
9878	greater than 4	664	437,770		
3895	greater than 4	349	20		
8976	greater than 4	700	185,750		
9976	greater than 4	567	76,690		
8253	greater than 4	597	51,960		
7407	greater than 4	645	168,960		
8031	greater than 4	509	717,240		
7414	greater than 4	530	249,300		
8603	greater than 4	893	279,100		
10630 (10863?)	greater than 4	685	375,320		
			5,265,610	X 1,000 gallons (1990)	

3- to 4-mile population: 35,301

Superintendent: Carl Edstrom

220

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Westbury Water Department Population: 20,050

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
5655	3 to 4	255	1,962,000	0.19	38
6819	3 to 4	265	---	---	---
5007	greater than 4	494			
7353	greater than 4	390			
101	greater than 4	341			
7785	greater than 4	400			
5654	greater than 4	538			
2602	greater than 4	800			
8497	greater than 4	539			
8007	greater than 4	564			
10451	greater than 4	512			
			1,023,535 X 1,000 gallons (1990)		

3- to 4-mile population: 38

Superintendent: Itall Vacchio

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: Jericho Water Department

Population: 58,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
8043	3 to 4	688	166,844	3.7	2,156
6651	3 to 4	610	411,734	9.2	5,321
7781	3 to 4	454	367,683	8.2	4,721
4245	3 to 4	565	355,659	7.9	4,596
7030	3 to 4	530	---	---	---
6092	greater than 4	631	194,554		
6093	greater than 4	606	165,020		
10149	greater than 4	625	151,023		
198	greater than 4	617	100,176		
199	greater than 4	600	219,336		
570	greater than 4	600	156,757		
11107	greater than 4	583	321,558		
11295	greater than 4	530	245,228		
3474	greater than 4	512	117,189		
3475	greater than 4	482	124,618		
7446	greater than 4	493	140,259		
7593	greater than 4	468	310,387		
8713	greater than 4	372	18,851		
5201	greater than 4	504	---		
7772	greater than 4	563	145,507		
7773	greater than 4	560	6,098		
8355	greater than 4	590	51,447		
			4,488,404	X 1,000 gallons (1990)	

3- to 4-mile population: 16,794

Superintendent: Joseph Passariello

222

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

Water Company: South Huntington Water Department Population: 55,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
12079	3 to 4	445	17,507,000	0.7	385
26248	3 to 4	552	256,559,000	10	5,500
30007	3 to 4	595	281,503,000	11	6,050
			2,556,259,300 gallons (1990)		

3- to 4-mile population: 11,935

Superintendent: Kevin Carroll

223

BETHPAGE FOUR-MILE-RADIUS
PUBLIC WATER SUPPLY APPORTIONMENT

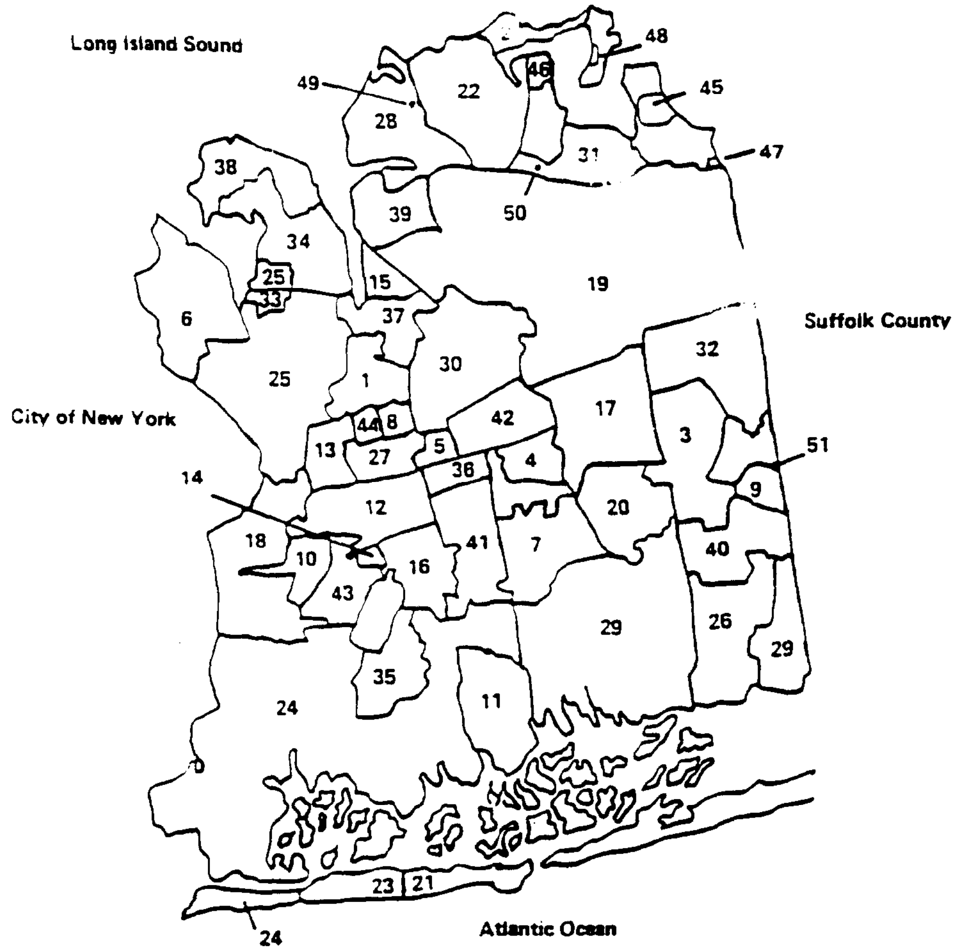
Water Company: East Farmingdale Water Department   Population: 55,000

Well Number	Distance (miles)	Depth (feet)	Total Volume	Percent Volume	Population
39709	3 to 4	723	109,956	14.4	821
20041	3 to 4	268	70,169	9.2	524
20042	3 to 4	585	---	---	---
5-1	greater than 4		---		
4-1	greater than 4		313,589		
4-2	greater than 4		267,749		
			761,463	X 1,000 gallons (1991)	

3- to 4-mile population: 1,345

Superintendent: George Veilson

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS



1. Albertson Water District
2. Bayville Village
3. Bethpage Water District
4. Bowling Green Water District
5. Carle Place Water District
6. Water Authority of Great Neck North
7. East Meadow Water District
8. East Williston Village
9. Farmingdale Village
10. Franklin Square Water District
11. Freeport Village
12. Garden City Village
13. Garden City Park Water District
14. Garden City South Water District
15. Glenwood Water District
16. Hempstead Village
17. Hicksville Water District
18. Jamaica Water Supply Company
19. Jericho Water District
20. Levittown Water District
21. Lido-Point Lookout Water District
22. Locust Valley Water District
23. Long Beach City
24. Long Island Water Corporation
25. Manhasset-Lakeville Water District
26. Massapequa Water District
27. Mineola Village
28. Glen Cove City
29. New York Water Service - Merrick Division
30. Old Westbury Village
31. Oyster Bay Water District
32. Plainview Water District
33. Plandome Village
34. Port Washington Water District
35. Rockville Centre Village
36. Roosevelt Field Water District
37. Roslyn Water District
38. Sands Point Village
39. Sea Cliff Water Company
40. South Farmingdale Water District
41. Uniondale Water District
42. Westbury Water District
43. West Hempstead-Hempstead Gardens Water District
44. Williston Park Village
45. Swan Cove Water Supply (Cove Neck)
46. Mill Neck Estates Water Supply
47. DeForest Drive Association
48. Split Rock Water Supply
49. North Shore University Hospital at Glen Cove
50. Planting Fields Arboretum Water Supply
51. Northeast Farmingdale Water District

Blank Areas - Parks, Lakes or Served by Private Wells

HEE - 67 Rev. 8/90

227

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

TREATMENT CODES

0 - None
1 - Chlorination (Routine)
2 - Chlorination (Emergency)
3 - Corrosion Control
  a - Caustic Soda
  b - Lime
  c - Zinc orthophosphate (inhibitor)
4 - Sequestration
  a - Sodium Hexametaphosphate
  b - Linear Chained Polyphosphate ("Aqua-Mag")
  c - Sodium Silicate
  d - Zinc metaphosphate
5 - Fluoridation
6 - VOC Removal
  a - Air Stripping
  b - Granular Activated Carbon (GAC)
7 - NO3 Removal
  a - Ion Exchange
8 - Iron Removal
  a - Filtration
  b - Aeration
  c - Sedimentation
  d - Coagulation
9 - Algae Control
  a - Copper Sulfate
10 - Taste and Odor Control
  a - Chlorination
  b - Aeration
11 - Other
  a - Polymers
  b - Magnasite
  c - Alum
12 - Treated Water Purchased
  a - Williston Park (V)
  b - West Hempstead W.D.
  c - Roslyn W.D.
  d - Farmingdale (V)
  e - Locust Valley W.D.

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
ALBERTSON W.D.	1	3732	2,3a
	2	3733	2,3a
	3	4327	2,3a,6a
	4	5947	2,3a,6a
	5	8558	2,3a
BAYVILLE (V)	1-1	7620	2,3a
	1-2	7643	2,3a
	1-3	8776	2,3a
	2-1	10144	2,3a
BETHPAGE W.D.	5-1	8004	2,3a
	6-1	3876	2,3a,6a
	6-2	8941	2,3a,6a
	7A	8767	2,3a
	8A	8768	2,3a
	9	6078	2,3a
	10	6915	2,3a
	11	6916	2,3a
	BDG-1	9591	2,3a
BOWLING GREEN W.D.	1	8956	1,3b
	2	8957	1,3b
CARLE PLACE W.D.	1	2747	2,3a,5
	2	2748	2,3a,5
	3	4206	2,3a,5
	4	6315	2,3a,5
	5	8457	2,3a,5
DEFOREST DRIVE W.S.	1	6953	1
EAST MEADOW W.D.	1	3456	1,3b
	2	3457	1,3b
	3	3465	1,3b
	4	4447	1,3b
	5	4448	1,3b
	6	5318	1,3b
	7	5319	1,3b
	8	5320	1,3b
	9	5321	1,3b
	10	5322	1,3b
	11	7797	1,3b
EAST WILLISTON (V)	-	-	2,12a
FARMINGDALE (V)	1-3	7852	2,3a,4a
	2-1	1937	2,3b,4a
	2-2	6644	2,3a,4a
	2-3	11004	2,3a,4a

229

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
FRANKLIN SQUARE W.D.	1	3603	2,3a
	2	3604	2,3a
	3	3605	2,3a,4a
	4	7117	2,3a,6b
	5	8818	2,3a,6b
FREEPORT (V)	1A	7796	2,3a,4a
	2	132	2,3a,4a
	3	133	2,3a,4a
	4	134	2,3a,4a
	5	68	2,3a,4a
	6	69	2,3a,4a
	7	5695	2,3a,4a
	8	5696	2,3a,4a
	9	8657	2,3a,4a
GARDEN CITY (V)	7	95	2,3a
	8	1697	2,3a
	9	3881	2,3a
	10	3934	2,3a,6a
	11	3935	2,3a,6a
	12	5163	2,3a
	13	7058	2,3a,6a
	14	8339	2,3a,6a
	15	10033	2,3a
	16	10034	2,3a
GARDEN CITY PARK W.D.	1	650	2,3a
	2	651	2,3a
	3	2565	2,3a
	4	3672	2,3a
	5	3673	2,3a
	6	5603	2,3a,6a
	7	6945	2,3a
	8	7512	2,3a
	9	8409	2,3a,7a
	10	9768	2,3a
	11	10612	2,3a
GARDEN CITY SOUTH W.D.	–	–	0,12b

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
GLEN COVE CITY	Morgan	835	2,3a
	Roxbury	5762	2,3a
	1S	3892	2,3a
	2S	5261	2,3a
	21	8326	2,3a
	30	9210	2,3a
	31	9211	2,3a
	Kelly	9334	2,3a,6a
GLENWOOD W.D.	-	-	2,12c
GREAT NECK NORTH, W.A. of	1	30	1,3a,4a
	2	22	1,3a
	4	31	1,3a,4a
	5	687	1,3a,4a
	6	1298	1,3a
	7	2214	1,3a
	8	3443	1,3a,4a
	9	4388	1,3a,4a,6a
	10	5884	1,3a,4a
	11	8342	1,3a
	21A	700	1,3a,6a
HEMPSTEAD (V)	1R	4425	1,3a,4a,6a
	2	79	1,3a,4a,6a,8b
	3	80	1,3a,4a,8b
	4	81	1,3a,4a,8b
	5	82	1,3a,4a,8b
	6	83	1,3a,4a,8b
	7	3668	1,3a,4a
	8	7298	1,3a,4a,8b
	9	8264	1,3a,4a
HICKSVILLE W.D.	1–4	7562	2,3a,4a
	1–5	8249	2,3a,4a,6a
	1–6	9488	2,3a,4a,6a
	2–2	5336	2,3a,4a
	3–2	8525	2,3a,4a
	4–2	8526	2,3a,4a
	5–2	7561	2,3a,4a,6b
	5–3	9212	2,3a,4a
	6–1	3953	2,3a,4a
	6–2	3878	2,3a,4a
	7–1	6190	2,3a,4a
	7–2	6191	2,3a,4a
	8–1	6192	2,3a,4a,6a

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
HICKSVILLE W.D. cont'd	8-2	6193	2,3a,4a
	8-3	9180	2,3a,4a,6a
	9-1	8778	2,3a,4a
	9-2	8779	2,3a,4a
	9-3	10208	2,3a,4a
	10-1	9463	2,3a,4a
	11-1	10555	2,3a,4a
JAMAICA W.S. CO.	9	14	1,3a,3c,5
	15A	9151	1,3a,3c,5
	15B	11037	1,3a,3c,5
	15C	10206	1,3a,3c,5
	15D	693	1,3a,3c,5
	15E	10207	1,3a,3c,5
	16A	1958	1,3a,3c,5
	20	17	1,3a,3c,5,6a
	25A	7482	1,3a,4d,5
	28	2414	1,3a,3c,5
	28A	11647	1,3a,4d,5
	28B	10211	1,3a,4d,5
	30	3720	1,3a,4d,5
	34	4512	1,3a,4d,5
	35	4077	1,3a,3c,5,6a
	35A	4298	1,3a,3c,5,6a
	40	4390	1,3a,3c,5,6a
	40A	7445	1,3a,3c,5,6a
	44	5155	1,3a,3c,5
	44A	5156	1,3a,3c,5
	44B	6744	1,3a,3c,5
	44C	6745	1,3a,3c,5
	57	7649	1,3a,3c,5,6a
	57A	7650	1,3a,3c,5,6a
JERICHO W.D.	3	198	2,3a
	4	199	2,3a
	5	570	2,3a
	6	3474	2,3a
	7	3475	2,3a
	9	4245	2,3a
	11	5201	2,3a
	12	6092	2,3a
	13	6093	2,3a
	14	6651	2,3a
	15	7030	2,3a

232

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
JERICHO W.D. cont'd	16	7446	2,3a
	17	7593	2,3a
	18	7772	2,3a
	19	7773	2,3a
	20	10149	2,3a
	22	7781	2,3a
	23	8043	2,3a
	25	8355	2,3a
	27	8713	2,3a
	29	11107	2,3a
	30	11295	2,3a
LEVITTOWN W.D.	2A	8321	1,3a
	3	2580	1,3a
	5A	7076	1,3b
	6A	3618	1,3a
	7A	8279	1,3b
	8A	7523	1,3b
	9	4450	1,3b
	10	4451	1,3b
	11	5301	1,3b
	12	5302	1,3b
	13	5303	1,3b
	14	5304	1,3a
LIDO-POINT LOOKOUT W.D.	1	46	1,3b,8a,8b
	2	5227	1,3b,8a,8b
	3	8354	1,3a,8a,8b,11b
LOCUST VALLEY W.D.	4	118	2
	5	119	2
	6	1651	2,3a
	7	5152	2,3a
	8	7665	2,3a
LONG BEACH CITY	9	2597	1,3b,8a,8b,8c,8d,11c
	10	3687	1,3b,8a,8b,8c,8d,11c
	11	5308	1,3b,8a,8b,8c,8d,11c
	12	6450	1,3b,8a,8b,8c,8d,11c
	13	7776	1,3b,8a,8b,8c,8d,11c
	14	8011	1,3b,8a,8b,8c,8d,11c
	15	8233	1,3b,8a,8b,8c,8d,11c
	16	8557	1,3b,8a,8b,8c,8d,11c

233

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
L.I. WATER CORPORATION	1-13	1601	1,3b,4c
	1-15	3722	1,3b,4c
	1-16	3832	1,3b,4c
	1-17	6893	1,3b,4c
	2-1	1602	1,3b,4c
	3-1	1603	1,3b,4c
	3-2	3520	1,3b,4c
	4-1	1402	1,3b,4c
	4-16	2613	1,3b,4c
	4-17	8196	1,3b,4c
	5(CS)	1346	1,3b,4c,8a,8b,9a
	6-1	4405	1,3b,8a,8b
	7-1A	9613	1,3b,4c,8a,8b
	7-2	2578	1,3b,4c,8a,8b
	7-3	5145	1,3b,4c,8a,8b
	8-1	3937	1,3b,4c
	8-2	4394	1,3b,4c
	9-1	8420	1,3b,4c
	9-2A	10286	1,3b,4c
	10-1	4393	1,3b,4c
	12-1	4132	1,3b,4c
	12-2	5153	1,3b,4c
	14-1	4411	1,3b,4c
	15-1	5121	1,3b,4c
	15-2	8251	1,3b,4c
	16-1	5187	1,3b,4c
	17-1	5656	1,3b,4c
	17-2	7521	1,3b,4c
	18-1	5653	1,3b,4c
	18-2	8250	1,3b,4c
	19-1	6146	1,3b,4c
	19-2	7522	1,3b,4c
	20-1	7548	1,3b,4c
	22-1	7831	1,3b,4c
	23-1	7855	1,3b,4c
	23-2	10103	1,3b,4c
	24-1	8195	1,3b,4c
	24-2	8979	1,3b,4c

234

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT		LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
MANHASSET-LAKEVILLE W.D.				
	CUMBERLAND	1	5099	2
	EAST SHORE ROAD	S	7747	1,3a
		D	9308	2,3a
	EXPRESSWAY	6	5710	2
	LAKEVILLE ROAD	7	1802	2
	MUNSEY PARK	8	3523	2
	PARKWAY #1	12	3905	1
	#2	4T	4243	1
	SHELTER ROCK ROAD #1	21	1328	2,3a
	#2	25	10557	2,3a
	VALLEY ROAD	22	1618	2
	EDEN WELL	23	7651	2
	CAMPBELL #1	1T	7126	1
	#2	3T	7892	1
	SEARINGTOWN ROAD #1	5T	2028	1
	# 2	6T	5528	1
	SPRUCE POND	26	10889	2,3a
MASSAPEQUA W.D.		1	4602	1,3a,4b,10a
		2R	9173	1,3a,4b,10a
		3	5703	1,3a,4b,10a
		4	6442	1,3a,4b,10a
		5	6443	1,3a,4b,10a
		6	6866	1,3a,4b,10a
		7	6867	1,3a,4b,10a
		8	8214	1,3a,4b,10a
MILL NECK ESTATES W.S.		1	6042	1
		2	8426	1
MINEOLA (V)		1	97	2,3a
		3	578	2,3a
		4	3185	2,3a
		5	4082	2,3a
		6	5596	2,3a
		7	8576	2,3a

235

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT		LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
N.Y. WATER CORPORATION				
	NEWBRIDGE ROAD	1N	3895	1,3a,4a,10a
		3N	8976	1,3a,4a,10a
		4N	9878	1,3a,4a,10a
	SEAMANS NECK ROAD	2S	3893	1,3a,4a,10a
		3S	8480	1,3a,4a,10a
		4S	9338	1,3a,4a,10a
	JERUSALEM AVE	4J	9514	1,3a,4a,10a
		5J	10195	1,3a,4a,10a
	CHARLES ST	2C	9976	1,3a,4a,10a
	JEFFERSON ST	11J	7407	1,3a,4a,10a
		12J	8253	1,3a,4a,10a
	DE MOTT AVE	4D	5767	1,3a,4a,10a
		5D	8837	1,3a,4a,10a
		6D	9910	1,3a,4a,10a
	MASSAPEQUA	6M	7414	1,3a,4a,10a
		7M	8603	1,3a,4a,10a
		8M	10863	1,3a,4a,10a
	OLD MILL ROAD	1O	8031	1,3a,4a,10a
NORTHEAST FARMINGDALE W.D.		–	–	0,12d
NO SHORE UNIV HOSPITAL @ GC		1	5994	1,3a
OLD WESTBURY (V)		1	152	2,3a
		2A	7513	2,3a
		3	107	2,3a
		4	7549	2,3a
		5	8658	2,3a
OYSTER BAY W.D.		PLT 1	585	1,3a
		PLT 2	4400	2,3a
		6-1	8183	2,3a
		6-2	9520	2,3a
PLAINVIEW W.D.		1-1	4095	1,3b
		1-2	4096	1,3b
		2-1	7526	1,3b
		3-1	4097	1,3b
		3-2	6580	1,3b
		4-1	6076	1,3b
		4-2	6077	1,3b
		5-1	6956	1,3b
		5-2	7421	1,3b
		5-3	8054	1,3b
		5-4	8595	1,3b

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
PLANDOME (V)	1	28	2
	2	29	2
	3	3540	2
PLANTING FIELDS ARBORETUM W.S.	-	-	2,12c
PORT WASHINGTON W.D.			
NEULIST AVE	1N	1715	1,3a,4a
	2N	1716	1,3a,4a
	3N	2030	1,3a,4a
HEWLETT	4H	2052	1,4a,6b
SOUTHPORT	5S	4223	1,4a
BAR BEACH	6B	5029	1
RICKS	7R	5876	1,4a
MORLEY PARK	8M	7551	1,4a
	9M	7552	1,4a,6b
SANDY HOLLOW RD	1SH	4860	1,4a,6b
	2SH	6087	1,4a,6b
	3SH	4059	1,4a
STONYTOWN RD	10ST	9809	1,3a,4a
ROCKVILLE CENTRE (V)	3	50	2,3b,8b
	4	9792	2,3b,8b
	5	72	2,3b,8b
	6	3745	2,3b,8b
	7	5193	2,3b,8b
	8	5194	2,3b,8b
	9	5195	2,3b,8b
	10	6817	2,3b,8b
	11	8216	2,3b,8b
	12	8217	2,3b,8b
	13	8218	2,3b,8b
ROOSEVELT FIELD W.D.	1	5484	1,3b
	2	5485	1,3b
	4	6046	1,3b
	5	7957	1,3a
	7	9521	1,3a
	10	9846	1,3b

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
ROSLYN W.D.	1-8	1870	1
	2	2400	2,3a
	3	4265	2
	4	4623	2,3a
	5	5852	2,3a
	6	7104	2,3a
	7	7873	2,3a
	8	8010	2,3a
SANDS POINT (V)	1	36	2,3a
	2	37	2,3a
	3	4389	2,3a
	4	7157	2,3a
	5	8183	2,3a
	6	9446	2,3a
SEA CLIFF W.C.	GH	5792	1,3a,4a
	SC	7857	1,3a,4a
	D	901	1,4a
SOUTH FARMINGDALE W.D.	1-2	4043	1,3b,4b
	1-3	5148	1,3b,4b
	1-4	7377	1,3b,4b
	2-1	5147	1,3b,4b,8a,8b
	2-2	6149	1,3b,4b,8a,8b
	3-1	6150	1,3b,4b
	4-1	6148	1,3b,4b
	5-1	7515	1,3b,4b
	5-2	7516	1,3b,4b
	6-1	8664	1,3b,4b
	6-2	8665	1,3b,4b
SPLITROCK W.S.	1	UNK 2	2
SWAN COVE W.S.	1	2920	1
UNIONDALE W.D.	1	4756	1,3b
	2	4757	1,3b
	3	4758	1,3b
	4	4759	1,3b
	5	8474	1,3a
	6	8475	1,3a

238

REFERENCE NO. 7

Nassau County Department of Health

GROUND WATER AND PUBLIC WATER SUPPLY FACTS

JUNE [illegible]

THOMAS S. GULOTTA
COUNTY EXECUTIVE

GEORGE PICKETT, M.D., M.P.H.
COMMISSIONER

NASSAU COUNTY DEPARTMENT OF HEALTH
COMMUNITY PUBLIC WATER SYSTEMS
TREATMENT PROVIDED BY WELL

WATER DISTRICT	LOCAL WELL NO.	NYSDEC WELL NO.	TREATMENT
WESTBURY W.D.	6	101	2,3a
	7A	7785	2,3a
	9	2602	2,3a
	10	5007	2,3a
	11	5654	2,3a
	12	5655	2,3a
	12A	6819	2,3a
	14	7353	2,3a
	15	8007	2,3a
	16	8497	2,3a
	17	10451	2,3a
WEST HEMP-HEMP GARDENS W.D.	1	75	1,3a,4b
	2	76	1,3a,4b
	2A	9452	1,3a,4b
	3	2239	1,3a,4b
	4	3704	1,3a,4b
	5	4118	1,3a,4b
	6	5260	1,3a,4b
	7	7720	1,3a
	9	10408	1,3a,4b
	10	10401	1,3a,4b
WILLISTON PK (V)	1	103	2,3a
	2	104	2,3a
	3	2487	2,3a
	4	8248	2,3a,6a

SOURCES:

(1) Public Water Supply Annual Inspection Reports (GEN 200), NCDH, 1990.
(2) 1991 Water Supply Emergency Plans.
(3) Water Supply Survey by NCDH, 1990.

NASSAU COUNTY DEPARTMENT OF HEALTH

CHLORINATION WAIVER AND CHLORINATING SYSTEMS FOR 1990 – 1992 (a)
COMMUNITY PUBLIC WATER SYSTEMS

WATER SUPPLIES WITH WAIVERS	ESTIMATED POPULATION (b)	WATER SUPPLIES THAT CHLORINATE	ESTIMATED POPULATION (b)
(1)	(2)	(3)	(4)
ALBERTSON WD	13,500	BOWLING GREEN WD	12,000
BAYVILLE (V)	8,800	DEFOREST DR ASSOC	21
BETHPAGE WD	33,000	EAST MEADOW WD	50,000
CARLE PLACE WD	11,050	GARDEN CITY SOUTH WD (d)	1,500
EAST WILLISTON (V)	2,600	WA of GREAT NECK NORTH	31,401
FARMINGDALE (V)	8,446	HEMPSTEAD (V)	41,000
(N/E FARMINGDALE WD) (c)	405	JAMAICA WS CO	130,000
FRANKLIN SQUARE WD	20,000	LEVITTOWN WD	50,000
FREEPORT (V)	40,000	LIDO-PT LOOKOUT WD	4,500
GARDEN CITY PARK WD	21,000	LONG BEACH CITY	35,000
GARDEN CITY (V)	23,000	LONG IS WATER CORP	237,550
GLEN COVE CITY	27,000	MASSAPEQUA WD	46,000
GLENWOOD WD	640	MILL NECK EST WS	240
HICKSVILLE WD	47,810	NY WATER SERVICE CORP	176,000
JERICHO WD	58,000	NO SHORE UNIV HOSP @ GC(e)	1,400
LOCUST VALLEY WD	7,500	ROOSEVELT FIELD WD	1,900
MANHASSET-LAKEV WD	43,000	SEA CLIFF WATER CO	17,850
MINEOLA (V)	20,600	SWAN COVE WS	80
OLD WESTBURY (V)	3,200	SO FARMINGDALE WD	49,900
OYSTER BAY WD	9,000	UNIONDALE WD	23,000
PLAINVIEW WD	35,000	WEST HEMPSTEAD WD	32,031
PLANDOME (V)	1,600		
PLANTING FIELDS ARBOR WS	90		
PORT WASHINGTON WD	38,000		
ROCKVILLE CENTRE (V)	28,000		
ROSLYN WD	28,000		
SANDS POINT (V)	2,795		
WESTBURY WD	20,050		
WILLISTON PARK (V)	8,216		
WAIVER:		CHLORINATING:	
SUPPLIES	29	SUPPLIES (f)	21
POPULATION	560,302	POPULATION	941,373
PERCENT OF POPULATION	37.3%	PERCENT OF POPULATION	62.7%

(a) Chlorination waivers issued for 3 year period beginning January 1, 1990.

(b) Public Water System Annual Inspection Report, GEN 200, 1990.

(c) Consecutive water system supplied by Village of Farmingdale which has a waiver.

(d) Supplied by West Hempstead-Hempstead Gardens W.D. which chlorinates.

(e) Formerly Glen Cove Community Hospital.

(f) Split Rock W.S. did not apply for a waiver and did not chlorinate in 1990.

NASSAU COUNTY DEPARTMENT OF HEALTH

COMMUNITY PUBLIC WATER SYSTEM POPULATION, PUMPAGE AND PER CAPITA CONSUMPTION IN 1990 NASSAU COUNTY, NEW YORK

WATER SUPPLY	ESTIMATED POPULATION	TOTAL PUMPAGE (Galx1000)	IMPORTED OR (EXPORTED) (Galx1000)	GALLONS PER CAPITA DAY (GPCD)
(1)	(2)	(3)	(4)	(5)
ALBERTSON WD	13,500	685,162		139
BAYVILLE (V)	8,800	285,450		89
BETHPAGE WD	33,000	1,185,922		98
BOWLING GREEN WD	12,000	179,722	213,311	90
CARLE PLACE WD	11,050	480,448		119
GREAT NECK NO. WA of	31,401	1,482,857		129
DEFOREST DR ASSOC	21	(a)		(a)
EAST MEADOW WD	50,000	2,297,771		126
EAST WILLISTON (V)	2,600	0	100,000	105
FARMINGDALE (V)	8,446	388,203		126
FRANKLIN SQUARE WD	20,000	672,912		92
FREEPORT (V)	40,000	1,743,160		119
GARDEN CITY PARK WD	21,000	1,067,622		139
GARDEN CITY SOUTH WD	1,500	0	(a)	(a)
GARDEN CITY (V)	23,000	1,329,540		158
GLEN COVE CITY	27,000	1,370,627		139
NO SHORE UNIV HOSP@GC (d)	1,400	TRANSIENT POPULATION		(b)
GLENWOOD WD	640	0	70,497	302
HEMPSTEAD (V)	41,000	2,301,028		154
HICKSVILLE WD	47,810	2,337,594		134
JAMAICA WS CO	130,000	3,764,700		79
JERICHO WD	58,000	3,770,306		178
LEVITTOWN WD	50,000	1,6[illegible]022		90
LIDO-PT LOOKOUT WD	4,500	31[illegible].348		192
LOCUST VALLEY WD	7,500	444,295		162
LONG BEACH CITY	35,000	1,284,379		101
LONG IS WATER CORP	237,550	9,749,605		112
MANHASSET-LAKEV WD	43,000	2,182,475	(120,000)	131
MASSAPEQUA WD	46,000	1,780,656		106
MILL NECK EST WS	240	(a)		(a)
MINEOLA (V)	20,600	952,566		127
N/E FARMINGDALE WD	405	INCLUDED IN VILLAGE OF FARMINGDALE		
NY WATER SERVICE CORP	176,000	5,265,610		82
OLD WESTBURY (V)	3,200	464,899		398

NASSAU COUNTY DEPARTMENT OF HEALTH

PUBLIC WATER SUPPLY WELLS WITH EXISTING OR POTENTIAL RESTRICTIONS DUE TO VOLATILE ORGANIC CHEMICALS

DECEMBER 31, 1990

WATER SUPPLY	NOT USED		TREATMENT **		
	RESTRICTED FOR EXCEEDING GUIDELINES	VOLUNTARILY NOT USED, COULD EXCEED MCLs	TREATED TO MEET MCL	TREATED DID NOT EXCEED MCL	TREATMENT PLANNED
(1)	(2)	(3)	(4)	(5)	(6)
COMMUNITY SYSTEMS					
ALBERTSON W.D.	NONE	NONE	3,4		
BAYVILLE (V)	1-2	NONE			
BETHPAGE W.D.	NONE	NONE	6-1	6-2*	
BOWLING GREEN W.D.	NONE	NONE			1*,2*
CARLE PLACE W.D.	NONE	NONE			
DeFOREST DRIVE ASSOC	NONE	NONE			
EAST MEADOW W.D.	NONE	2,4			
EAST WILLISTON (V)	NONE	NONE			
FARMINGDALE (V)	NONE	NONE			
FRANKLIN SQUARE W.D.	NONE	NONE	5	4*	
FREEPORT (V)	NONE	NONE			
GARDEN CITY PK W.D.	4,5	9	6		9,7*,10*
GARDEN CITY (V)	NONE	9,11,12,	10,13,14		11
GARDEN CITY SOUTH W.D.	NONE	NONE			
GLEN COVE CITY	1-S,21	2-S	KELLY ST		
GLENWOOD W.D.	NONE	NONE			
GREAT NECK NORTH, W.A. OF	NONE	NONE	21A,9		8*
HEMPSTEAD (V)	1-R	6		2*	1-R,6
HICKSVILLE W.D.	NONE	1-4,2-2,4-2 6-1	5-2 1-5,1-6 8-1,8-3		4-2
JAMAICA W.S. CO.	NONE	15D,44,44A 44C	57,57A,40 20,35,35A	40A*	
JERICHO W.D.	NONE	15			
LEVITTOWN W.D.	NONE	10			
LIDO-PT LOOKOUT W.D.	NONE	NONE			
LOCUST VALLEY W.D.	NONE	NONE			
LONG BEACH CITY	NONE	NONE			
LONG ISLAND W. CORP.	NONE	1-16,5R			5R
MANHASSET-LAKE W.D.	6	7,23,5T,6T			7,22* 4T*,12*,6 5T,6T

242

NASSAU COUNTY DEPARTMENT OF HEALTH

PUBLIC WATER SUPPLY WELLS WITH EXISTING OR POTENTIAL RESTRICTIONS DUE TO VOLATILE ORGANIC CHEMICALS

DECEMBER 31, 1990

	NOT USED		TREATMENT **		
WATER SUPPLY	RESTRICTED FOR EXCEEDING GUIDELINES	VOLUNTARILY NOT USED, COULD EXCEED MCLs	TREATED TO MEET MCL	TREATED DID NOT EXCEED MCL	TREATMENT PLANNED
(1)	(2)	(3)	(4)	(5)	(6)
MASSAPEQUA W.D.	NONE	NONE			
MILL NECK ESTATES W.S.	NONE	NONE			
MINEOLA (V)	NONE	4			4
NEW YORK WATER SERVICE	NONE	NONE			
N/E FARMINGDALE W.D.	NONE	NONE			
NO SHORE UNIV HOSP @ GC	NONE	NONE			
OLD WESTBURY (V)	NONE	NONE			
OYSTER BAY W.D.	NONE	NONE			
PLAINVIEW W.D.	NONE	NONE			5-1*, 5-2* 5-3*, 5-4*
PLANDOME (V)	NONE	NONE			
PLANTING FIELDS W.S.	NONE	NONE			
PT WASHINGTON W.D.	NONE	NONE	**MP-9**	**H4*, SH1*, SH2***	
ROCKVILLE CENTRE (V)	NONE	NONE			
ROOSEVELT FIELD W.D.	NONE	NONE			
ROSLYN W.D.	NONE	2			
SANDS POINT (V)	NONE	NONE			
SEA CLIFF WATER CO	NONE	NONE			
SO FARMINGDALE W.D.	NONE	NONE			
SPLIT ROCK W.S.	NONE	NONE			
SWAN COVE W.S.	NONE	NONE			
UNIONDALE W.D.	NONE	NONE			
WESTBURY W.D.	NONE	6			
WEST HEMPSTEAD W.D.	NONE	4			
WILLISTON PARK (V)	NONE	NONE		4*	3*
NON-COMMUNITY SYSTEMS					
BETHPAGE ST PARK	1	NONE			
SAGAMORE HILL	NONE	2			

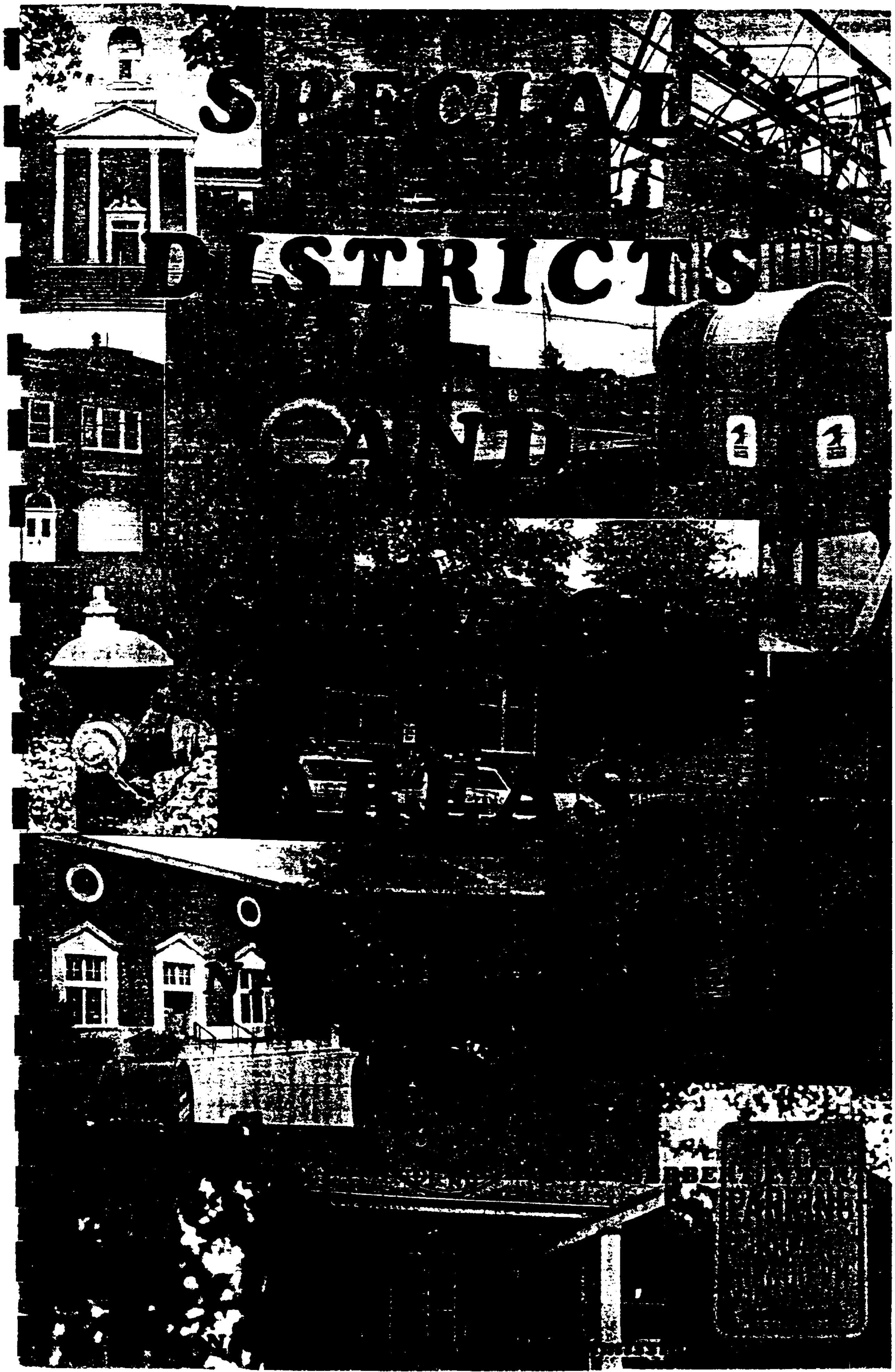
* MCLs were not exceeded in these wells.

** Treatment by Air-Stripping unless noted.

GAC Treatment

243

REFERENCE NO. 8



245

Table 5

WATER DISTRICTS AND WATER SUPPLY

THE FOLLOWING AREA AND POPULATION INFORMATION FOR WATER SERVICES IN NASSSAU COUNTY IS UTILIZED IN CONJUNCTION WITH PLATE 5

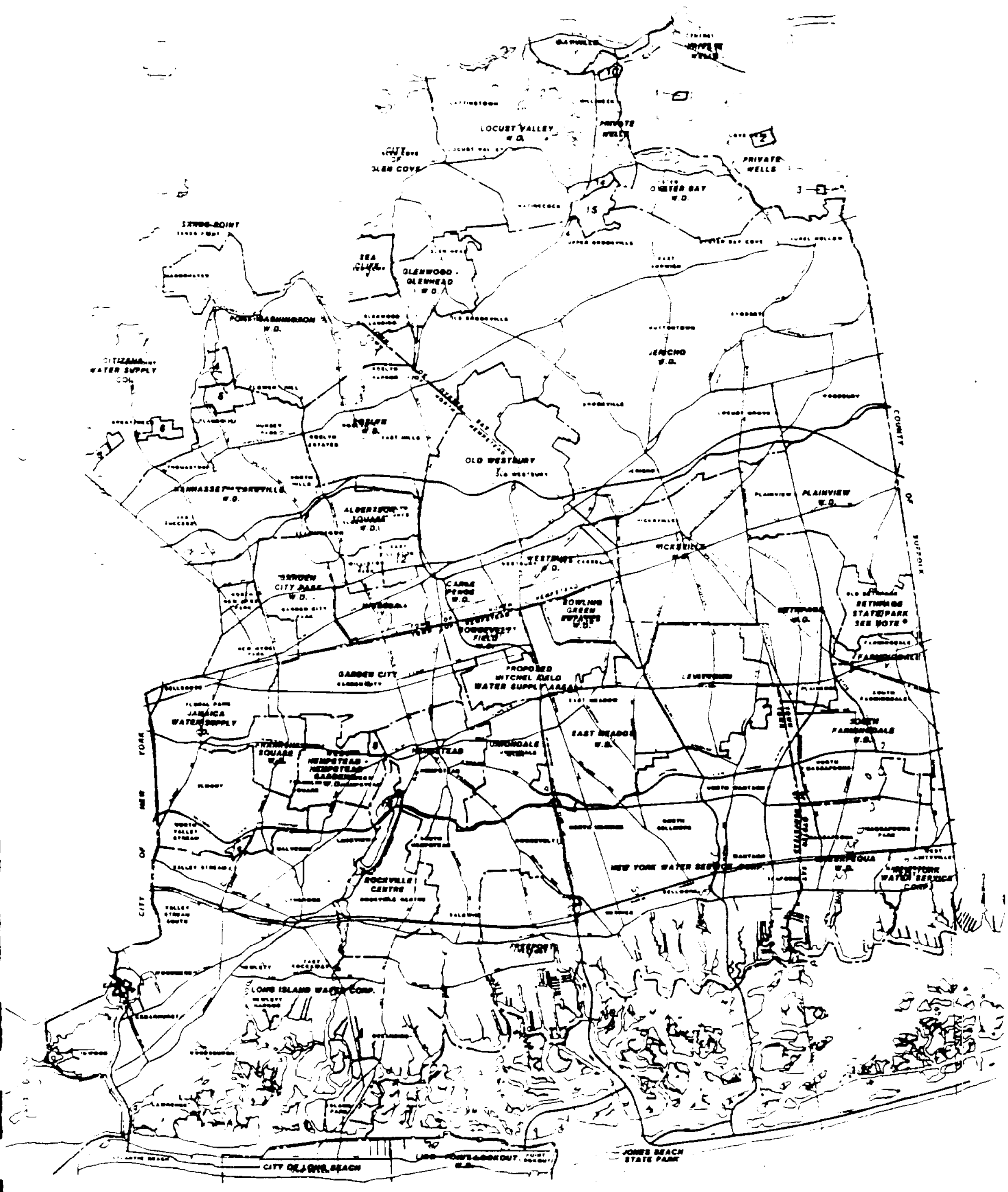
	Type of Service	Population 1980 U.S. Census	Population NCPC Estimate	Area (Acres)
TOWN OF HEMPSTEAD				
Bethpage***	W.D.		3,100	296
Bowling Green Estates	W.D.		9,700	887
East Meadow	W.D.		42,150	3,580
Franklin Square	W.D.		16,800	1,039
Freeport	V.	38,272		3,508
Garden City	V.	22,927		3,413
Garden City South	W.D.		1,050	87
Hempstead	V.	40,404		2,327
Hicksville***	W.D.		5,400	497
Jamaica Water Supply*	PVT.		73,650	5,166
Levittown	W.D.		41,950	3,112
Lido-Point Lookout	W.D.		4,500	1,476
Long Beach	CITY	34,073		1,590
Long Island Water Corp.	PVT.		238,950	27,054
New York Water Service Corp..	PVT.		126,650	12,496
Mineola*	V.	52		11
Rockville Centre	V.	25,405		2,196
Roosevelt Field	W.D.		100	858
Uniondale	W.D.		23,100	2,005
West Hempstead-Hempstead Gardens	W.D.		23,000	1,556
Mitchel Field Water Supply Area	(PROPOSED)		1,250	1,970
TOWN OF NORTH HEMPSTEAD				
Albertson Square	W.D.		11,650	1,453
Carle Place	W.D.		9,300	987
Citizens Water Supply Co.	PVT.		22,500	3,922
East Williston	V.	2,708		369
Garden City	V.	0		1
Garden City Park	W.D.		19,900	2,022
Glenwood	W.D.		350	282
Great Neck	W.D.		2,450	272
Jamaica Water Supply*	PVT.		18,150	1,140
Manhasset-Lakeville	W.D.		32,600	6,099
Mineola*	V.	20,705		1,186
Old Westbury***	V.	2,175		3,328
Plandome	V.	1,503		315
Port Washington	W.D.		27,150	4,220
Roslyn	W.D.		16,700	3,463
Sands Point	V.	2,742		2,743
Westbury	W.D.		19,750	2,151
Williston Park	V.	8,216		390
TOWN OF OYSTER BAY				
Bayville	V.	7,034		924
Bethpage**	W.D.		24,850	3,557
Farmingdale	V.	7,946		696
Glen Cove	CITY	24,618		4,336
Glenwood-Glenhead	W.D.		6,650	1,878
Hicksville**	W.D.		42,600	4,470
Jericho	W.D.		55,300	24,034
Locust Valley	W.D.		7,050	5,443
Massapequa	W.D.		44,950	4,028
New York Water Service Corp.*	PVT.		17,600	2,229
Northeast Farmingdale	W.S.D.		400	59
Old Westbury*	V.	1,102		1,819
Oyster Bay	W.D.		6,300	2,358
Plainview	W.D.		32,700	5,190
Sea Cliff	V.	5,364		752
South Farmingdale	W.D.		43,300	3,817
DeForest Drive	P.W.A.		30	12
Mill Neck Estates	P.W.A.		250	60
SEL VRA	P.W.A.		80	60
Split Rock	P.W.A.		70	20

* Part in Town of North Hempstead
** Part in Town of Hempstead;
*** Part in Town of Oyster Bay
W.D. - Water District

W.S.D. - Water Supply District
V. - Village
PVT. - Private Company
P.W.A. - Private Water Association

Area Sources: Long Island Regional Planning Board, Existing Land Use, 1968; Nassau County Planning Commission planimeter estimates

Population Sources: 1980 U.S. Census and Nassau County Planning Commission estimates based on 1980 U. S. Census



LEGEND

V. - VILLAGE
W.D. - WATER DISTRICT
W.S.D. - WATER SUPPLY DISTRICT

AREA IDENTIFICATION

1. SPLIT ROCK ASSOCIATION
2. SEL VRA ASSOCIATION
3. DEFOREST ASSOCIATION
4. MANHASSET - LAKEVILLE W.D.
5. PLANDOME V.
6. GREAT NECK W.D.
7. GLENWOOD W.D.
8. GARDEN CITY SOUTH W.D.
9. NORTHEAST FARMINGDALE W.S.D.
10. MILL NECK ESTATES
11. WILLISTON PARK V.
12. EAST WILLISTON V.
13. HEMPSTEAD LAKE STATE PARK - SERVICED BY LONG ISLAND WATER CORP. AND ROCKVILLE CENTRE V.
14. OYSTER BAY W.D.
15. PLANTING FIELDS ARBORETUM - SERVICED BY PRIVATE WELLS
16. VALLEY STREAM STATE PARK - SERVICED BY LONG ISLAND WATER CORP. AND JAMAICA WATER SUPPLY CO.

*NOTE: BETHPAGE STATE PARK - SERVICED BY BETHPAGE W.D. AND PLAINVIEW W.D.

NOTE:
INFORMATION SHOWN ON THIS MAP HAS BEEN OBTAINED FROM THE OFFICE OF THE NASSAU COUNTY DEPARTMENTS OF ASSESSMENT AND HEALTH

WATER SUPPLY AND WATER DISTRICTS

THE NASSAU COUNTY PLANNING COMMISSION

DATE - OCT. 1984 PLATE 8

REFERENCE NO. 9

PLATE 1

NWIRP BETHPAGE FOUR-MILE-RADIUS MAP

REFERENCE NO. 10

PLATE 2

NWIRP BETHPAGE WETLAND AND SURFACE WATER MAP

251

BETHPAGE NWIRP WETLAND AND SURFACE WATER MAP

HALLIBURTON NUS Environmental Corporation

000199C01X

REFERENCE NO. 11

federal register

Friday
December 14, 1990

Part II

Environmental Protection Agency

40 CFR Part 300

Hazard Ranking System; Final Rule

253

If the site is in more than one watershed:

• Calculate a separate overland/flood migration component score for each watershed, using likelihood of release, waste characteristics, and targets applicable to each watershed.

• Select the highest overland/flood migration component score from the watersheds evaluated and assign it as the overland/flood migration component score for the site.

4.1.2 *Drinking water threat.* Evaluate the drinking water threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.2.1 *Drinking water threat—likelihood of release.* Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential to release factor.

4.1.2.1.1 *Observed release.* Establish an observed release to surface water for a watershed by demonstrating that the site has released a hazardous substance to the surface water in the watershed. Base this demonstration on either:

• Direct observation:

–A material that contains one or more hazardous substances has been seen entering surface water through migration or is known to have entered surface water through direct deposition, or

–A source area has been flooded at a time that hazardous substances were present, and one or more hazardous substances were in contact with the flood waters, or

–When evidence supports the inference of a release of a material that contains one or more hazardous substances by the site to surface water, demonstrated adverse effects associated with that release may also be used to establish an observed release.

• Chemical analysis:

–Analysis of surface water, benthic, or sediment samples indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site for that type of sample (see section 2.3).

– –Limit comparisons to similar types of samples and background concentrations—for example, compare surface water samples to surface water background concentrations.

– –For benthic samples, limit comparisons to essentially sessile organisms.

–Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the site itself consists of contaminated sediments with no identified source, no separate attribution is required.

If an observed release can be established for a watershed, assign an observed release factor value of 550 to that watershed, enter this value in Table 4–1, and proceed to section 4.1.2.1.3. If no observed release can be established for the watershed, assign an observed release factor value of 0 to that watershed, enter this value in Table 4–1, and proceed to section 4.1.2.1.2.

4.1.2.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established for the watershed. Evaluate potential to release based on two components: potential to release by overland flow (see section 4.1.2.1.2.1) and potential to release by flood (see section 4.1.2.1.2.2). Sum the values for these two components to obtain the potential to release factor value for the watershed, subject to a maximum value of 500.

4.1.2.1.2.1 *Potential to release by overland flow.* Evaluate potential to release by overland flow for the watershed based on three factors: containment, runoff, and distance to surface water.

Assign potential to release by overland flow a value of 0 for the watershed if:

• No overland segment of the hazardous substance migration path can be defined for the watershed, or

• The overland segment of the hazardous substance migration path for the watershed exceeds 2 miles before surface water is encountered.

If either condition applies, enter a value of 0 in Table 4–1 and proceed to section 4.1.2.1.2.2 to evaluate potential to release by flood. If neither applies, proceed to section 4.1.2.1.2.1.1 to evaluate potential to release by overland flow.

4.1.2.1.2.1.1 *Containment.* Determine the containment factor value for the watershed as follows:

• If one or more sources is located in surface water in the watershed (for example, intact sealed drums in surface water), assign the containment factor a value of 10 for the watershed. Enter this value in Table 4–1.

• If none of the sources is located in surface water in the watershed, assign a containment factor value from Table 4–2 to each source at the site that can potentially release hazardous substances to the hazardous substance migration path for this watershed. Assign the containment factor value for the watershed as follows:

–Select the highest containment factor value assigned to those sources that meet the minimum size requirement described below. Assign this highest value as the containment factor value for the watershed. Enter this value in Table 4–1.

–If, for this watershed, no source at the site meets the minimum size requirement, then select the highest containment factor value assigned to the sources at the site eligible to be evaluated for this watershed and assign it as the containment factor value for the watershed. Enter this value in Table 4–1.

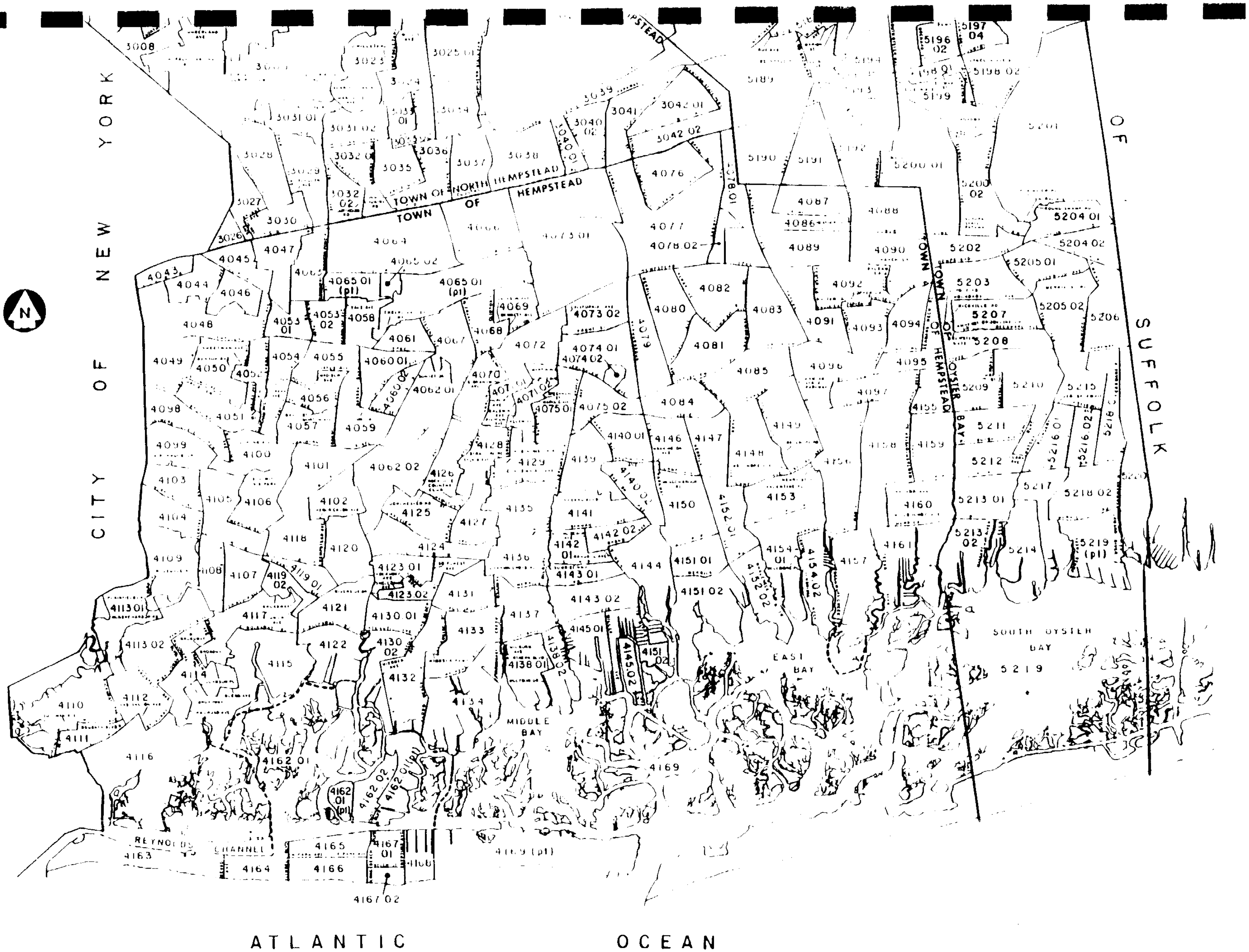
A source meets the minimum size requirement if its source hazardous waste quantity value (see section 2.4.2.1.5) is 0.5 or more. Do not include the minimum size requirement in evaluating any other factor of this surface water migration component, except potential to release by flood as specified in section 4.1.2.1.2.2.3.

4.1.2.1.2.1.2 *Runoff.* Evaluate runoff based on three components: rainfall, drainage area, and soil group.

TABLE 4–2.—CONTAINMENT FACTOR VALUES FOR SURFACE WATER MIGRATION PATHWAY

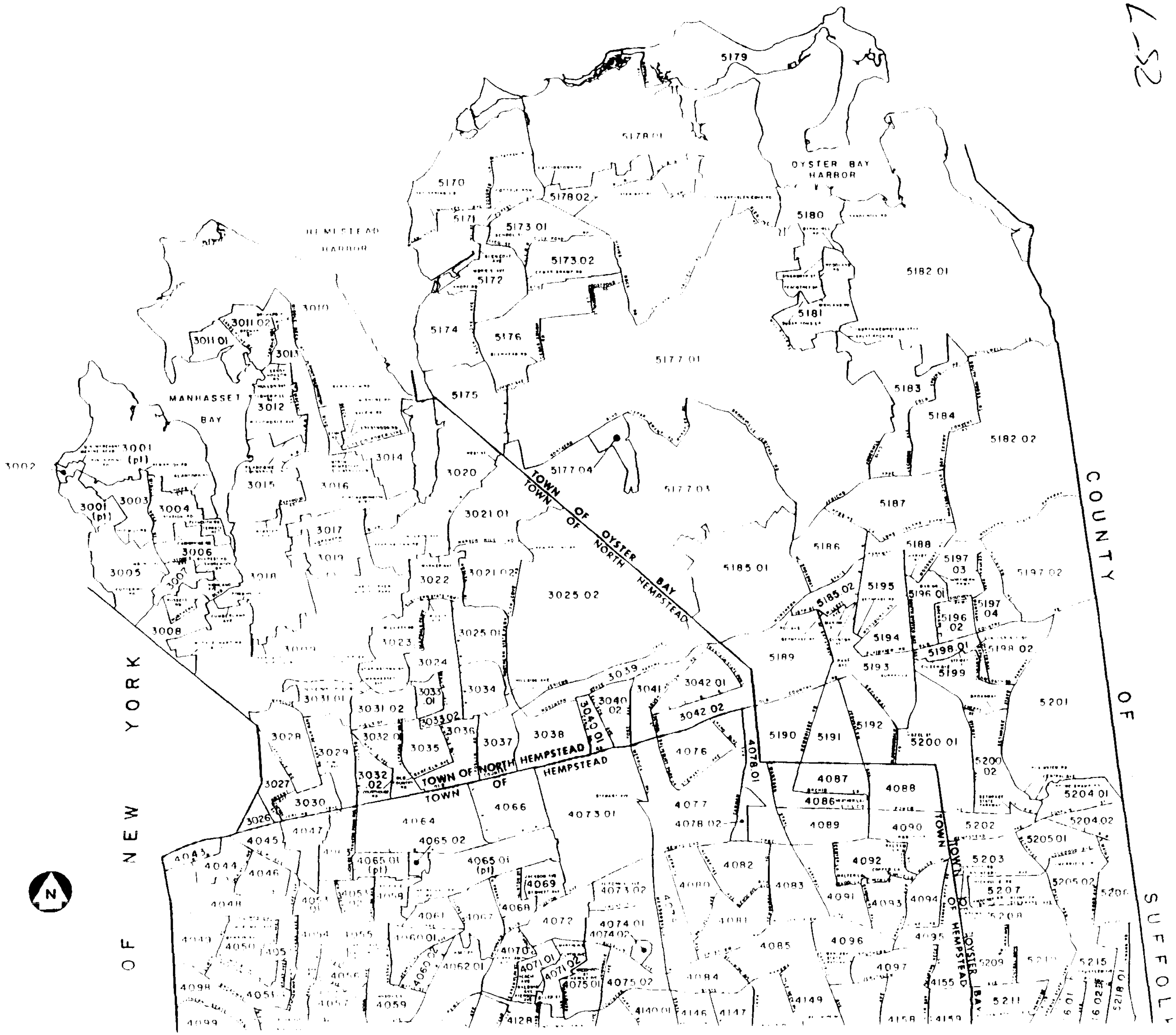
Source	Assigned value
All Sources (Except Surface Impoundments, Land Treatment, Containers, and Tanks)	
Evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures)	10
No evidence of hazardous substance migration from source area *and:*	
(a) Neither of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system.	10
(b) Any one of the two items in (a) present	9
(c) Any two of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system, or (3) liner with functioning leachate collection and removal system immediately above liner.	7
(d) All items in (c) present	5
(e) All items in (c) present, plus no bulk or non-containerized liquids nor materials containing free liquids deposited in source area	3
No evidence of hazardous substance migration from source area, double liner with functioning leachate collection and removal system above and between liners, *and:*	
(f) Only one of the following deficiencies present in containment: (1) bulk or noncontainerized liquids or materials containing free liquids deposited in source area, or (2) no or nonfunctioning or nonmaintained run-on control system and runoff management system; or (3) no or nonmaintained engineered cover.	3
(g) None of the deficiencies in (f) present	0
Source area inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate is generated, liquids or materials containing free liquids not deposited in source area, and functioning and maintained run-on control present	

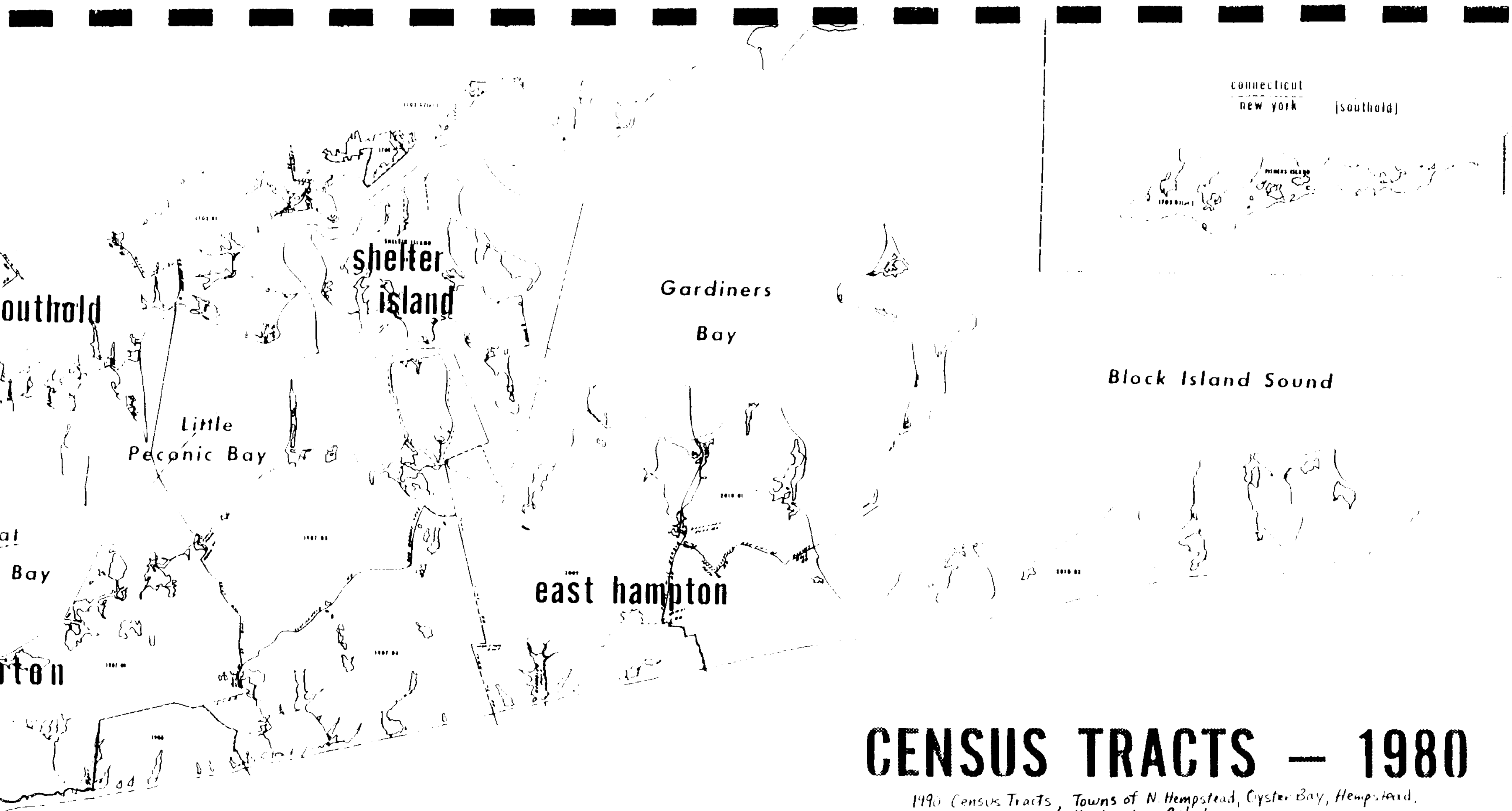
REFERENCE NO. 12



CENSUS TRACTS 1980

252


L-32
OYSTER BAY HARBOR
HEMPSTEAD HARBOR
MANHASSET BAY
TOWN OF OYSTER BAY
TOWN OF NORTH HEMPSTEAD
TOWN OF HEMPSTEAD
COUNTY OF SUFFOLK
OF NEW YORK
N
5179
5178.01
5178.02
5170
5171
5173.01
5173.02
5172
5174
5176
5175
5177.01
5177.04
5177.03
5180
5181
5182.01
5182.02
5183
5184
5185.01
5185.02
5186
5187
5188
5189
5190
5191
5192
5193
5194
5195
5196.01
5196.02
5197.02
5197.03
5197.04
5198.01
5198.02
5199
5200.01
5200.02
5201
5202
5203
5204.01
5204.02
5205.01
5205.02
5207
5208
5209
5211
5215
3001 (pt)
3002
3003
3004
3005
3006
3007
3008
3010
3011.01
3011.02
3012
3013
3014
3015
3016
3017
3018
3019
3020
3021.01
3021.02
3022
3023
3024
3025.01
3025.02
3026
3027
3028
3029
3030
3031.01
3031.02
3032.01
3032.02
3033.01
3033.02
3034
3035
3036
3037
3038
3039
3040.01
3040.02
3041
3042.01
3042.02
4043
4044
4045
4046
4047
4048
4049
4050
4051
4056
4057
4059
4060.01
4061
4062.01
4064
4065.01 (pt)
4065.02
4066
4067
4068
4069
4070
4071.01
4071.02
4072
4073.01
4073.02
4074.01
4074.02
4075.01
4075.02
4076
4077
4078.01
4078.02
4080
4081
4082
4083
4084
4085
4086
4087
4088
4089
4090
4091
4092
4093
4094
4095
4096
4097
4098
4099
4128
4140.01
4146
4147
4149
4155
4158
4159



CENSUS TRACTS — 1980

1990 Census Tracts, Towns of N. Hempstead, Oyster Bay, Hempstead, Huntington, Babylon.

NASSAU COUNTY
SUFFOLK COUNTY

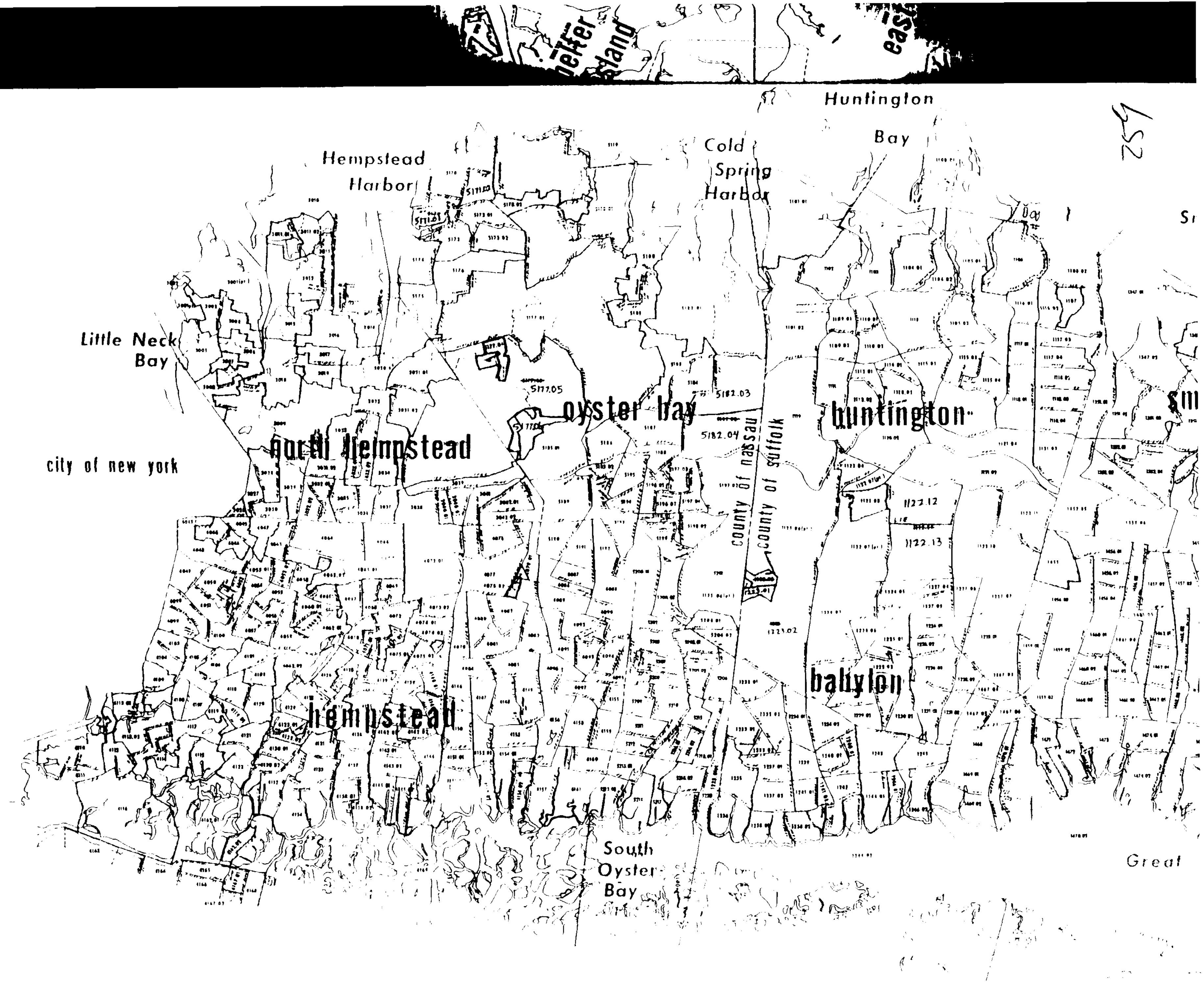
N

scale in miles

0 1 2 3 4

long island
new york

LONG ISLAND REGIONAL PLANNING BOARD



Huntington Bay
Hempstead Harbor
Cold Spring Harbor
Little Neck Bay
city of new york
north hempstead
oyster bay
huntington
county of nassau
county of suffolk
babylon
hempstead
South Oyster Bay
Great

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	--------Percent of Total Population-------- White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
	1287348	1115119	111057	1642	39299	20231	77386	86.6	8.6	0.1	3.1	1.6	6.0
3001	4200	3958	72	1	152	17	118	94.2	1.7	0.0	3.6	0.4	2.8
3002	657	617	7	3	24	6	23	93.9	1.1	0.5	3.7	0.9	3.5
3003	3804	3246	314	7	153	84	284	85.3	8.3	0.2	4.0	2.2	7.5
3004	4911	4600	108	8	146	49	294	93.7	2.2	0.2	3.0	1.0	6.0
3005	4650	4427	77	2	129	15	188	95.2	1.7	0.0	2.8	0.3	4.0
3006	6275	5803	96	0	313	63	336	92.5	1.5	0.0	5.0	1.0	5.4
3007	5857	5482	119	2	129	125	467	93.6	2.0	0.0	2.2	2.1	8.0
3008	4419	4008	109	0	242	60	276	90.7	2.5	0.0	5.5	1.4	6.2
3009	5683	5000	102	0	557	24	142	88.0	1.8	0.0	9.8	0.4	2.5
3010	4576	4117	61	0	382	16	140	90.0	1.3	0.0	8.3	0.3	3.1
3011.01	5672	4834	48	10	469	311	931	85.2	0.8	0.2	8.3	5.5	16.4
3011.02	4172	3753	46	6	340	27	164	90.0	1.1	0.1	8.1	0.6	3.9
3012	5815	5388	66	6	264	91	456	92.7	1.1	0.1	4.5	1.6	7.8
3013	4954	3941	371	10	293	339	949	79.6	7.5	0.2	5.9	6.8	19.2
3014	2044	1860	10	0	166	8	90	91.0	0.5	0.0	8.1	0.4	4.4
3015	2989	2837	13	1	138	0	57	94.9	0.4	0.0	4.6	0.0	1.9
3016	4519	4094	39	0	355	31	167	90.6	0.9	0.0	7.9	0.7	3.7
3017	2692	2568	7	0	110	7	65	95.4	0.3	0.0	4.1	0.3	2.4
3018	4959	3523	1179	5	236	16	249	71.0	23.8	0.1	4.8	0.3	5.0
3019	2941	2819	8	0	105	9	101	95.9	0.3	0.0	3.6	0.3	3.4
3020	4050	3779	80	3	163	25	136	93.3	2.0	0.1	4.0	0.6	3.4
3021.01	4182	3857	67	1	223	34	125	92.2	1.6	0.0	5.3	0.8	3.0
3021.02	3267	3139	14	0	111	3	38	96.1	0.4	0.0	3.4	0.1	1.2
3022	3965	3215	528	4	180	38	223	81.1	13.3	0.1	4.5	1.0	5.6
3023	5116	4275	34	0	798	9	109	83.6	0.7	0.0	15.6	0.2	2.1
3024	5142	4743	9	4	362	24	114	92.2	0.2	0.1	7.0	0.5	2.2
3025.01	2440	2295	31	4	108	2	32	94.1	1.3	0.2	4.4	0.1	1.3
3025.02	2659	2244	123	1	275	16	103	84.4	4.6	0.0	10.3	0.6	3.9
3026	2233	2162	1	0	68	2	64	96.8	0.0	0.0	3.0	0.1	2.9
3027	3858	3477	0	9	353	19	119	90.1	0.0	0.2	9.1	0.5	3.1
3028	6095	5684	6	0	395	10	201	93.3	0.1	0.0	6.5	0.2	3.3

022

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	--------Percent of Total Population-------- White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
3029	4406	4150	1	0	252	3	151	94.2	0.0	0.0	5.7	0.1	3.4
3030	5576	5227	2	3	327	17	206	93.7	0.0	0.1	5.9	0.3	3.7
3031.01	3722	3040	11	0	651	20	69	81.7	0.3	0.0	17.5	0.5	1.9
3031.02	4167	3664	13	0	479	11	130	87.9	0.3	0.0	11.5	0.3	3.1
3032.01	3748	2868	353	4	482	41	115	76.5	9.4	0.1	12.9	1.1	3.1
3032.02	3735	3313	69	4	318	29	204	88.8	1.8	0.1	8.5	0.8	5.5
3033.01	3258	3091	2	1	158	6	68	94.9	0.1	0.0	4.8	0.2	2.1
3033.02	4188	4057	28	6	86	11	146	96.9	0.7	0.1	2.1	0.3	3.5
3034	2515	2412	9	0	86	8	33	95.9	0.4	0.0	3.4	0.3	1.3
3035	5513	5288	0	1	191	33	347	95.9	0.0	0.0	3.5	0.6	6.3
3036	6490	6070	71	9	169	171	750	93.5	1.1	0.1	2.6	2.6	11.6
3037	6991	6700	119	6	116	50	450	95.8	1.7	0.1	1.7	0.7	6.4
3038	5107	4836	53	5	169	44	292	94.7	1.0	0.1	3.3	0.9	5.7
3039	3792	2033	1450	16	233	60	208	53.6	38.2	0.4	6.1	1.6	5.5
3040.01	2495	2428	8	0	48	11	110	97.3	0.3	0.0	1.9	0.4	4.4
3040.02	3478	3264	99	1	62	52	236	93.8	2.8	0.0	1.8	1.5	6.8
3041	3183	1748	1148	14	137	136	612	54.9	36.1	0.4	4.3	4.3	19.2
3042.01	7552	1137	6015	41	24	335	1536	15.1	79.6	0.5	0.3	4.4	20.3
3042.02	2705	1661	726	2	104	212	530	61.4	26.8	0.1	3.8	7.8	19.6
4043	3115	2851	30	10	166	58	250	91.5	1.0	0.3	5.3	1.9	8.0
4044	5231	5134	9	1	80	7	116	98.1	0.2	0.0	1.5	0.1	2.2
4045	4182	4020	32	6	74	50	192	96.1	0.8	0.1	1.8	1.2	4.6
4046	4417	4318	6	3	70	20	149	97.8	0.1	0.1	1.6	0.5	3.4
4047	6138	5919	12	9	182	16	169	96.4	0.2	0.1	3.0	0.3	2.8
4048	5533	3276	1884	11	81	281	862	59.2	34.1	0.2	1.5	5.1	15.6
4049	8343	4918	2092	49	1013	271	1230	58.9	25.1	0.6	12.1	3.2	14.7
4050	4212	3850	73	2	213	74	387	91.4	1.7	0.0	5.1	1.8	9.2
4051	7015	5213	912	14	709	167	610	74.3	13.0	0.2	10.1	2.4	8.7
4052	4987	4772	10	3	114	88	325	95.7	0.2	0.1	2.3	1.8	6.5
4053.01	3258	3169	5	2	66	16	109	97.3	0.2	0.1	2.0	0.5	3.3
4053.02	3991	3928	9	0	35	19	128	98.4	0.2	0.0	0.9	0.5	3.2
4054	6931	6715	9	1	150	56	342	96.9	0.1	0.0	2.2	0.8	4.9

192

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

								--------Percent of Total Population--------					
Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
4055	5073	4981	11	3	62	16	145	98.2	0.2	0.1	1.2	0.3	2.9
4056	4204	4107	3	4	76	14	128	97.7	0.1	0.1	1.8	0.3	3.0
4057	4748	4563	12	4	157	12	152	96.1	0.3	0.1	3.3	0.3	3.2
4058	4073	3976	6	3	67	21	141	97.6	0.1	0.1	1.6	0.5	3.5
4059	4933	4658	53	5	204	13	142	94.4	1.1	0.1	4.1	0.3	2.9
4060.01	4394	4190	35	6	120	43	214	95.4	0.8	0.1	2.7	1.0	4.9
4060.02	2933	2842	17	8	61	5	80	96.9	0.6	0.3	2.1	0.2	2.7
4061	2798	2688	49	0	26	35	103	96.1	1.8	0.0	0.9	1.3	3.7
4062.01	2604	2281	187	0	98	38	168	87.6	7.2	0.0	3.8	1.5	6.5
4062.02	5476	336	4948	55	45	92	321	6.1	90.4	1.0	0.8	1.7	5.9
4063	3638	3541	4	4	89	0	71	97.3	0.1	0.1	2.4	0.0	2.0
4064	6393	6233	20	1	131	8	113	97.5	0.3	0.0	2.0	0.1	1.8
4065.01	6393	6161	18	2	199	13	197	96.4	0.3	0.0	3.1	0.2	3.1
4065.02	1137	880	198	0	40	19	80	77.4	17.4	0.0	3.5	1.7	7.0
4066	4079	3895	7	1	165	11	65	95.5	0.2	0.0	4.0	0.3	1.6
4067	7198	3099	3338	30	134	597	1414	43.1	46.4	0.4	1.9	8.3	19.6
4068	7743	3465	3104	57	154	963	3621	44.8	40.1	0.7	2.0	12.4	46.8
4069	6158	788	5044	37	54	235	696	12.8	81.9	0.6	0.9	3.8	11.3
4070	6346	407	5645	38	33	223	486	6.4	89.0	0.6	0.5	3.5	7.7
4071.01	4462	616	3693	13	26	114	386	13.8	82.8	0.3	0.6	2.6	8.7
4071.02	4940	1240	3353	15	72	260	647	25.1	67.9	0.3	1.5	5.3	13.1
4072	12649	6415	4934	35	351	914	2204	50.7	39.0	0.3	2.8	7.2	17.4
4073.01	1098	478	596	7	13	4	52	43.5	54.3	0.6	1.2	0.4	4.7
4073.02	4245	2469	1342	12	148	254	596	58.6	31.6	0.3	3.5	6.0	14.0
4074.01	6645	3372	2590	33	229	421	932	50.7	39.0	0.5	3.4	6.3	14.0
4074.02	914	774	138	1	1	0	5	84.7	15.1	0.1	0.1	0.0	0.5
4075.01	3990	1430	2059	21	69	411	881	35.8	51.6	0.5	1.7	10.3	22.1
4075.02	4534	1049	3249	24	73	139	469	23.1	71.7	0.5	1.6	3.1	10.3
4076	5499	4962	37	2	440	58	265	90.2	0.7	0.0	8.0	1.1	4.8
4077	4578	4410	8	11	136	13	195	96.3	0.2	0.2	3.0	0.3	4.3
4078.01	5309	5026	20	9	215	39	216	94.7	0.4	0.2	4.0	0.7	4.1
4078.02	2439	827	1261	0	155	196	238	33.9	51.7	0.0	6.4	8.0	9.8

292

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

								--------Percent of Total Population--------					
Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
4079	4932	4232	460	4	143	93	308	85.8	9.3	0.1	2.9	1.9	6.2
4080	6142	5931	29	3	158	18	199	96.6	0.5	0.0	2.6	0.3	3.2
4081	6667	6402	33	0	208	24	168	96.0	0.5	0.0	3.1	0.4	2.5
4082	6442	6142	13	5	236	46	197	95.3	0.2	0.1	3.7	0.7	3.1
4083	7127	6783	27	9	267	36	240	95.2	0.4	0.1	3.7	0.5	3.4
4084	3709	3520	60	0	116	13	105	94.9	1.6	0.0	3.1	0.4	2.8
4085	5958	5793	27	0	123	15	123	97.2	0.5	0.0	2.1	0.3	2.1
4086	4541	4403	22	0	92	24	139	97.0	0.5	0.0	2.0	0.5	3.1
4087	4957	4792	18	6	112	29	227	96.7	0.4	0.1	2.3	0.6	4.6
4088	7000	6765	16	5	152	62	360	96.6	0.2	0.1	2.2	0.9	5.1
4089	5908	5753	9	6	110	30	239	97.4	0.2	0.1	1.9	0.5	4.0
4090	5989	5771	17	3	157	41	254	96.4	0.3	0.1	2.6	0.7	4.2
4091	5721	5589	15	4	84	29	230	97.7	0.3	0.1	1.5	0.5	4.0
4092	6325	6203	22	2	69	29	300	98.1	0.3	0.0	1.1	0.5	4.7
4093	4619	4534	4	2	61	18	172	98.2	0.1	0.0	1.3	0.4	3.7
4094	4219	4140	6	3	57	13	150	98.1	0.1	0.1	1.4	0.3	3.6
4095	4007	3933	8	0	56	10	113	98.2	0.2	0.0	1.4	0.2	2.8
4096	5030	4901	11	2	96	20	163	97.4	0.2	0.0	1.9	0.4	3.2
4097	4488	4401	12	3	64	8	124	98.1	0.3	0.1	1.4	0.2	2.8
4098	5164	2737	1662	31	558	176	600	53.0	32.2	0.6	10.8	3.4	11.6
4099	5963	5207	211	14	445	86	415	87.3	3.5	0.2	7.5	1.4	7.0
4100	3447	3192	63	6	153	33	158	92.6	1.8	0.2	4.4	1.0	4.6
4101	6278	6081	24	1	159	13	196	96.9	0.4	0.0	2.5	0.2	3.1
4102	3953	3733	101	3	92	24	217	94.4	2.6	0.1	2.3	0.6	5.5
4103	5375	4966	18	1	323	67	244	92.4	0.3	0.0	6.0	1.2	4.5
4104	4290	4007	66	2	174	41	265	93.4	1.5	0.0	4.1	1.0	6.2
4105	6192	5805	22	3	263	99	339	93.8	0.4	0.0	4.2	1.6	5.5
4106	6978	6741	17	4	191	25	195	96.6	0.2	0.1	2.7	0.4	2.8
4107	6060	5829	9	1	159	62	251	96.2	0.1	0.0	2.6	1.0	4.1
4108	5051	4883	17	2	114	35	220	96.7	0.3	0.0	2.3	0.7	4.4
4109	5328	5024	35	1	266	2	91	94.3	0.7	0.0	5.0	0.0	1.7
4110	4284	3554	533	6	48	143	475	83.0	12.4	0.1	1.1	3.3	11.1

322

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

								--------Percent of Total Population--------					
Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
4111	3483	1803	1507	15	29	129	414	51.8	43.3	0.4	0.8	3.7	11.9
4112	5716	5420	94	4	123	75	239	94.8	1.6	0.1	2.2	1.3	4.2
4113.01	3541	3413	17	0	104	7	54	96.4	0.5	0.0	2.9	0.2	1.5
4113.02	6260	6113	35	0	100	12	98	97.7	0.6	0.0	1.6	0.2	1.6
4114	5777	5419	126	2	163	67	178	93.8	2.2	0.0	2.8	1.2	3.1
4115	3405	3283	36	0	81	5	64	96.4	1.1	0.0	2.4	0.1	1.9
4116	6513	6229	146	12	66	60	280	95.6	2.2	0.2	1.0	0.9	4.3
4117	6620	6258	40	2	202	118	342	94.5	0.6	0.0	3.1	1.8	5.2
4118	6291	6095	26	5	116	49	290	96.9	0.4	0.1	1.8	0.8	4.6
4119.01	3107	2931	31	0	61	84	184	94.3	1.0	0.0	2.0	2.7	5.9
4119.02	3726	3634	5	0	81	6	136	97.5	0.1	0.0	2.2	0.2	3.7
4120	6081	5780	42	4	150	105	331	95.1	0.7	0.1	2.5	1.7	5.4
4121	6673	6508	23	4	79	59	263	97.5	0.3	0.1	1.2	0.9	3.9
4122	5762	5663	17	3	59	20	124	98.3	0.3	0.1	1.0	0.3	2.2
4123.01	3503	3305	66	1	62	69	417	94.3	1.9	0.0	1.8	2.0	11.9
4123.02	3660	3512	48	5	39	56	273	96.0	1.3	0.1	1.1	1.5	7.5
4124	5263	4333	751	3	52	124	504	82.3	14.3	0.1	1.0	2.4	9.6
4125	4522	4442	22	1	40	17	84	98.2	0.5	0.0	0.9	0.4	1.9
4126	3793	3660	54	8	57	14	54	96.5	1.4	0.2	1.5	0.4	1.4
4127	4002	3948	25	0	25	4	75	98.7	0.6	0.0	0.6	0.1	1.9
4128	3014	2716	164	4	88	42	128	90.1	5.4	0.1	2.9	1.4	4.2
4129	5479	3243	2035	9	127	65	324	59.2	37.1	0.2	2.3	1.2	5.9
4130.01	4240	4138	26	8	34	34	227	97.6	0.6	0.2	0.8	0.8	5.4
4130.02	3732	3631	6	2	70	23	138	97.3	0.2	0.1	1.9	0.6	3.7
4131	5026	4834	17	9	109	57	198	96.2	0.3	0.2	2.2	1.1	3.9
4132	6716	6504	26	16	90	80	379	96.8	0.4	0.2	1.3	1.2	5.6
4133	6889	6775	34	3	63	14	162	98.3	0.5	0.0	0.9	0.2	2.4
4134	5820	5678	19	2	94	27	147	97.6	0.3	0.0	1.6	0.5	2.5
4135	6836	6163	419	7	202	45	340	90.2	6.1	0.1	3.0	0.7	5.0
4136	5244	4915	121	3	153	52	322	93.7	2.3	0.1	2.9	1.0	6.1
4137	5160	4943	49	3	130	35	321	95.8	0.9	0.1	2.5	0.7	6.2
4138.01	3923	3755	19	2	134	13	134	95.7	0.5	0.1	3.4	0.3	3.4

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

--------Percent of Total Population--------

Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
4138.02	3976	3797	58	3	104	14	110	95.5	1.5	0.1	2.6	0.4	2.8
4139	7107	842	6006	32	36	191	775	11.8	84.5	0.5	0.5	2.7	10.9
4140.01	4090	131	3827	13	13	106	250	3.2	93.6	0.3	0.3	2.6	6.1
4140.02	3833	212	3498	21	9	93	284	5.5	91.3	0.5	0.2	2.4	7.4
4141	6383	1746	4251	19	35	332	701	27.4	66.6	0.3	0.5	5.2	11.0
4142.01	4553	2529	1069	37	59	859	1654	55.5	23.5	0.8	1.3	18.9	36.3
4142.02	3999	1127	2315	31	34	492	1023	28.2	57.9	0.8	0.9	12.3	25.6
4143.01	2900	1860	459	21	70	490	868	64.1	15.8	0.7	2.4	16.9	29.9
4143.02	7271	5353	845	33	102	938	2050	73.6	11.6	0.5	1.4	12.9	28.2
4144	5025	1715	2801	12	51	446	1323	34.1	55.7	0.2	1.0	8.9	26.3
4145.01	5277	4191	834	6	95	151	518	79.4	15.8	0.1	1.8	2.9	9.8
4145.02	4486	4000	313	3	61	109	322	89.2	7.0	0.1	1.4	2.4	7.2
4146	3699	3575	29	1	73	21	94	96.6	0.8	0.0	2.0	0.6	2.5
4147	4705	4569	12	3	109	12	112	97.1	0.3	0.1	2.3	0.3	2.4
4148	6697	6530	44	6	98	19	182	97.5	0.7	0.1	1.5	0.3	2.7
4149	7052	6575	254	12	155	56	257	93.2	3.6	0.2	2.2	0.8	3.6
4150	5934	5735	11	2	150	36	173	96.6	0.2	0.0	2.5	0.6	2.9
4151.01	2938	2828	35	1	63	11	52	96.3	1.2	0.0	2.1	0.4	1.8
4151.02	5349	5216	33	3	67	30	72	97.5	0.6	0.1	1.3	0.6	1.3
4152.01	4009	3936	13	1	46	13	87	98.2	0.3	0.0	1.1	0.3	2.2
4152.02	4812	4716	30	0	64	2	70	98.0	0.6	0.0	1.3	0.0	1.5
4153	5799	5648	31	7	78	35	215	97.4	0.5	0.1	1.3	0.6	3.7
4154.01	5656	5561	17	1	65	12	133	98.3	0.3	0.0	1.1	0.2	2.4
4154.02	4983	4911	11	1	50	10	59	98.6	0.2	0.0	1.0	0.2	1.2
4155	2758	2711	9	3	31	4	79	98.3	0.3	0.1	1.1	0.1	2.9
4156	5386	5253	2	0	[illegible]	22	104	97.5	0.0	0.0	2.0	0.4	1.9
4157	6160	6074	7	4	[illegible]	18	137	98.6	0.1	0.1	0.9	0.3	2.2
4158	7021	6887	20	2	103	9	150	98.1	0.3	0.0	1.5	0.1	2.1
4159	5156	5069	11	3	53	20	135	98.3	0.2	0.1	1.0	0.4	2.6
4160	4107	4046	7	0	33	21	126	98.5	0.2	0.0	0.8	0.5	3.1
4161	6334	6184	10	5	128	7	123	97.6	0.2	0.1	2.0	0.1	1.9
4162.01	3997	3916	19	1	50	11	180	98.0	0.5	0.0	1.3	0.3	4.5

592

NRACE3 WK1

NASSAU COUNTY MINORITY POPULATION BY CENSUS TRACT - 1990

Tract	Total	White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic	--------Percent of Total Population-------- White	Black	Am Ind Eskimo Aleut	Asian	Other	Hispanic
5209	4953	4874	11	1	54	13	130	98.4	0.2	0.0	1.1	0.3	2.6
5210	5271	5233	4	1	27	6	84	99.3	0.1	0.0	0.5	0.1	1.6
5211	4482	4422	3	0	40	17	78	98.7	0.1	0.0	0.9	0.4	1.7
5212	2779	2738	6	1	27	7	35	98.5	0.2	0.0	1.0	0.3	1.3
5213.01	2300	2256	11	3	24	6	74	98.1	0.5	0.1	1.0	0.3	3.2
5213.02	5835	5768	17	2	38	10	92	98.9	0.3	0.0	0.7	0.2	1.6
5214	6622	6470	7	4	124	17	139	97.7	0.1	0.1	1.9	0.3	2.1
5215	5190	5082	3	0	94	11	104	97.9	0.1	0.0	1.8	0.2	2.0
5216.01	4416	4366	5	3	40	2	83	98.9	0.1	0.1	0.9	0.0	1.9
5216.02	3561	3533	2	0	22	4	65	99.2	0.1	0.0	0.6	0.1	1.8
5217	4877	4779	7	1	86	4	84	98.0	0.1	0.0	1.8	0.1	1.7
5218.01	3885	3807	8	0	58	12	114	98.0	0.2	0.0	1.5	0.3	2.9
5218.02	4141	4052	22	11	43	13	98	97.9	0.5	0.3	1.0	0.3	2.4
5219	4726	4629	4	7	79	7	122	97.9	0.1	0.1	1.7	0.1	2.6
5220	6798	4272	2095	27	194	210	756	62.8	30.8	0.4	2.9	3.1	11.1

note: Hispanics belong to any of the five racial categories

Source: U. S. Census 1990
Long Island Regional Planning Board

SUFFOLK COUNTY POPULATION BY CENSUS TRACT - 1990

	Total	White	Black	Am Ind Eskimo Aleut	Asian Pacific Islander	Other	Hispanic	Population 18 Years and Over Total	White	Black	Am Ind Eskimo Aleut	Asian Pacific Islander	Other	Hispanic	Total
Suffolk County	1321864	1190315	82910	2794	23100	22545	87852	995276	905118	56737	2075	16211	15135	60562	326588
Tract 1101.01	3349	3293	14	1	35	6	56	2550	2505	14	1	26	4	33	799
Tract 1101.02	4783	4712	11	4	55	1	61	3713	3659	11	4	38	1	40	1070
Tract 1102	5221	5097	55	3	57	9	67	4161	4069	42	2	44	4	47	1060
Tract 1103	5174	5039	63	6	52	14	109	4048	3963	36	6	36	7	77	1126
Tract 1104.01	2847	2809	8	3	24	3	34	2149	2125	7	1	15	1	26	698
Tract 1104.02	3171	3126	10	4	30	1	31	2498	2464	10	3	20	1	23	673
Tract 1105.01	2989	2936	8	0	43	2	54	2357	2325	6	0	25	1	41	632
Tract 1105.02	2755	2672	38	0	40	5	55	2149	2100	22	0	22	5	44	606
Tract 1106	7569	7418	47	3	91	10	152	5944	5841	33	3	58	9	113	1625
Tract 1106.99	3	3	0	0	0	0	1	3	3	0	0	0	0	1	0
Tract 1107	148	139	8	0	1	0	1	142	133	8	0	1	0	1	6
Tract 1108.01	2341	2297	13	1	26	4	35	1902	1872	7	1	18	4	30	439
Tract 1108.02	5602	5505	11	0	80	6	82	4268	4191	10	0	64	3	57	1334
Tract 1109.01	2659	2517	72	3	53	14	114	2138	2032	49	2	47	8	72	521
Tract 1109.02	3823	2608	936	10	89	180	498	2869	2092	604	8	67	98	321	954
Tract 1110.01	1935	1540	284	12	56	43	129	1577	1285	219	10	38	25	90	358
Tract 1110.02	3997	2815	726	13	56	387	1053	2984	2205	483	10	45	241	671	1013
Tract 1111	6526	4734	1425	16	142	209	928	4936	3711	967	11	103	144	615	1590
Tract 1112.01	3005	2492	321	14	38	140	517	2288	1953	209	9	30	87	346	717
Tract 1112.02	4472	4290	76	8	58	40	203	3477	3351	48	7	44	27	143	995
Tract 1113	4615	4447	69	2	94	3	79	3479	3365	53	2	58	1	57	1136
Tract 1114.01	1462	1331	84	6	40	1	21	1122	1029	61	6	25	1	16	340
Tract 1114.02	4962	4821	28	0	104	9	157	3842	3740	24	0	70	8	122	1120
Tract 1115.03	4706	4166	370	2	122	26	167	3640	3256	282	2	83	17	130	1066
Tract 1115.04	1375	1301	23	5	39	7	46	1088	1040	16	3	24	5	37	287
Tract 1115.05	6366	4373	1739	21	135	98	401	4876	3473	1230	15	97	61	291	1490
Tract 1115.06	2822	2306	374	9	88	45	164	2156	1792	276	6	54	28	117	666
Tract 1116.01	4116	3968	13	4	77	34	107	3146	3046	26	1	53	20	78	970
Tract 1116.02	3221	3166	14	2	24	15	85	2380	2342	10	1	19	8	54	841
Tract 1117.01	5239	5087	21	12	74	45	191	3957	3852	14	9	52	30	129	1282
Tract 1117.03	3097	2940	50	1	93	13	115	2405	2305	29	1	61	9	79	692
Tract 1117.04	3292	3202	32	0	48	10	60	2564	2504	21	0	33	6	40	728
Tract 1118.01	5424	5152	22	1	244	5	129	4252	4076	17	0	157	2	75	1172
Tract 1118.02	2933	2807	19	2	96	9	74	2328	2248	10	2	61	7	50	605
Tract 1118.03	2773	2660	19	1	91	2	70	2151	2082	15	1	51	2	37	622
Tract 1118.04	2200	2103	9	0	74	4	70	1738	1674	13	0	49	2	59	462
Tract 1119	5849	5627	20	2	198	2	98	4492	4336	17	2	135	2	78	1357
Tract 1120.01	4527	4377	18	1	100	31	158	3636	3524	14	1	73	24	128	891
Tract 1120.02	5097	4995	33	0	66	3	75	4062	3987	23	0	51	1	62	1035
Tract 1121.02	4012	3776	51	2	178	5	90	3010	2855	36	2	113	4	67	1002
Tract 1121.03	4304	4173	7	0	103	21	110	3433	3341	4	0	70	18	85	871
Tract 1121.04	3330	3109	35	6	174	6	111	2569	2422	31	5	105	6	84	761
Tract 1122.04	3944	3830	27	2	78	7	102	3089	3011	16	1	56	5	77	855
Tract 1122.06	4544	4265	31	3	227	18	124	3394	3198	25	3	154	14	88	1150
Tract 1122.07	4098	3719	143	4	215	17	157	2987	2726	100	4	147	10	113	1111
Tract 1122.08	995	857	129	0	9	0	49	906	795	105	0	6	0	39	89
Tract 1122.10	6633	6155	186	12	250	30	214	5002	4675	123	6	175	23	165	1631

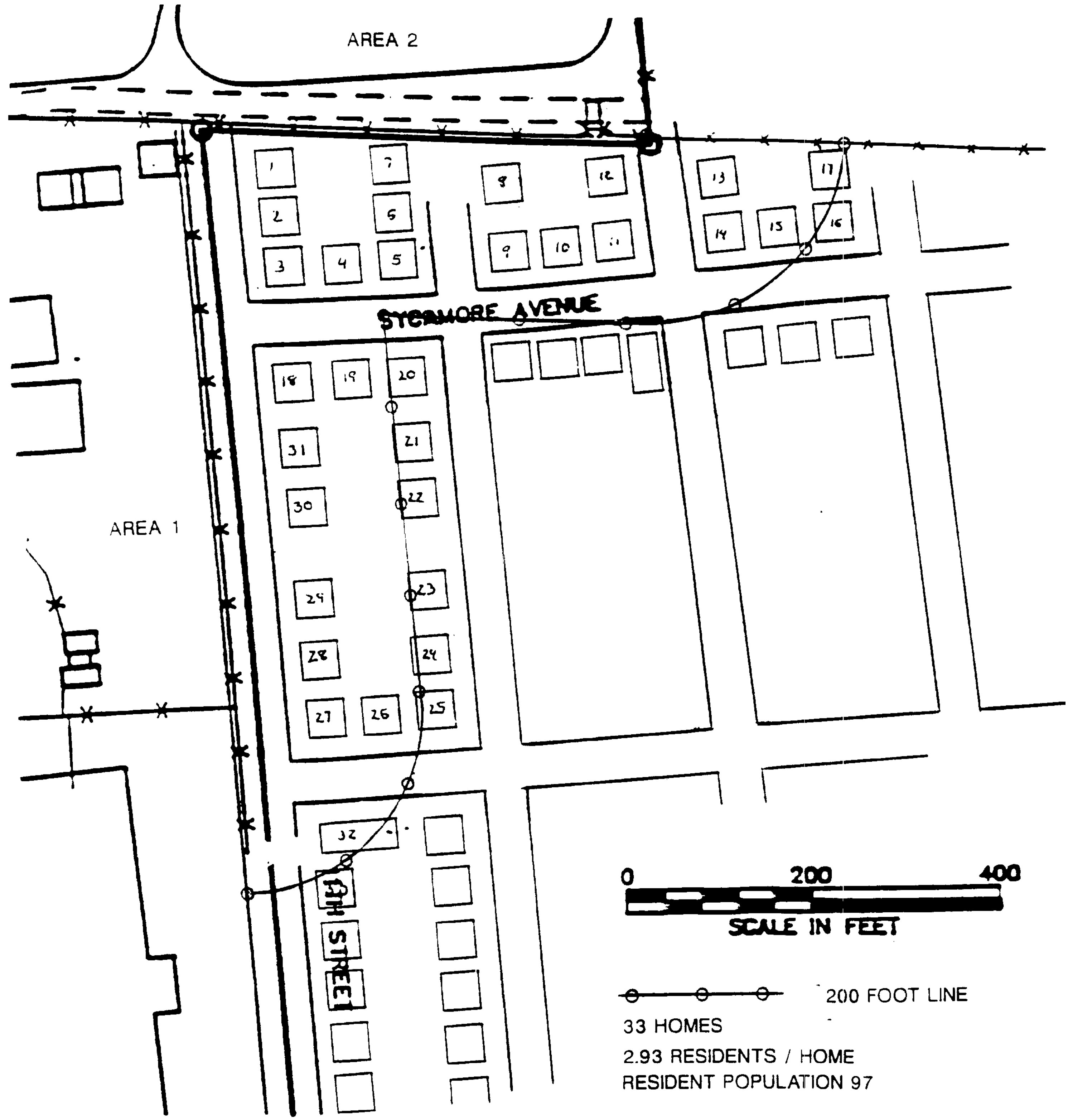
SUFFOLK COUNTY   POPULATION BY CENSUS TRACT - 1990

								--------------Population 18 Years and Over	--------------------					
	Total	White	Black	Am Ind Eskimo Aleut	Asian Pacific Islander	Other	Hispanic	Total	White	Black	Am Ind Eskimo Aleut	Asian Pacific Islander	Other	Hispanic
Tract 1122.11	4742	4484	69	4	171	14	112	3573	3390	47	2	121	13	91
Tract 1122.12	3239	2877	85	2	268	7	87	2464	2215	73	2	169	5	67
Tract 1122.13	5188	4666	181	2	328	11	174	3712	3389	105	0	212	6	114
Tract 1223.01	885	365	421	3	55	41	185	838	329	418	3	49	39	181
Tract 1223.02	3317	3178	43	3	50	33	129	2612	2508	30	3	48	23	94
Tract 1224.03	2308	1388	764	22	38	96	258	1687	1105	488	15	24	55	171
Tract 1224.04	3592	3527	9	1	27	28	156	2719	2681	6	0	16	16	99
Tract 1224.05	3483	1524	1667	47	141	104	345	2440	1190	1053	31	97	69	253
Tract 1224.06	4265	485	3422	22	13	323	773	2794	338	2204	18	10	224	510
Tract 1225.01	3367	134	3095	25	5	108	294	2125	106	1934	17	2	66	184
Tract 1225.02	4157	254	3765	32	34	72	229	3009	196	2718	20	21	54	152
Tract 1226.01	6125	5935	46	2	98	44	316	4830	4706	31	2	65	26	226
Tract 1226.02	4918	4831	13	0	51	23	189	3934	3875	10	0	34	15	149
Tract 1226.03	5832	5655	63	7	89	18	244	4552	4436	42	5	55	14	179
Tract 1227.04	2184	1710	396	1	45	32	152	1639	1315	278	1	25	20	104
Tract 1227.05	3256	3140	35	2	72	7	104	2531	2450	28	2	47	4	74
Tract 1227.06	4239	4040	33	17	111	38	257	3381	3234	26	11	79	31	188
Tract 1227.07	3271	3169	40	5	44	13	197	2551	2482	28	4	27	10	148
Tract 1228.01	5401	3166	2020	19	88	108	425	4146	2650	1353	14	64	65	282
Tract 1228.02	4150	4023	43	10	61	13	137	3236	3147	26	6	47	10	101
Tract 1229.01	5886	5761	11	6	45	63	232	4416	4328	10	5	20	43	162
Tract 1229.02	4400	4262	66	2	43	27	177	3358	3276	32	2	33	15	125
Tract 1230.01	6123	5950	43	7	64	59	343	4772	4651	28	6	44	43	252
Tract 1230.02	4829	4646	73	3	53	54	336	3630	3504	52	3	34	37	246
Tract 1231.01	3662	3521	32	11	72	26	171	2869	2766	27	8	50	18	123
Tract 1231.02	4437	4315	32	7	43	40	193	3490	3402	25	4	29	30	133
Tract 1232.01	1193	412	660	8	20	93	188	864	336	438	3	14	73	137
Tract 1232.02	5817	361	5233	53	24	146	448	4096	323	3614	38	10	111	325
Tract 1233.01	6516	1972	4210	86	84	164	535	4852	1687	2938	59	59	109	376
Tract 1233.02	1535	77	1366	48	20	24	149	1086	59	959	33	16	19	110
Tract 1234.01	3748	3521	117	3	45	62	238	2840	2674	86	3	32	45	166
Tract 1234.02	6815	6443	192	14	100	66	366	5269	4994	150	10	75	40	261
Tract 1235	5355	4449	695	17	70	124	488	4241	3583	498	15	55	90	347
Tract 1236	4053	3995	17	5	30	6	64	3259	3216	14	3	23	3	47
Tract 1237.01	4982	3650	828	36	97	371	1331	3696	2779	562	25	71	259	911
Tract 1237.02	7284	6984	70	2	76	152	481	5709	5501	41	2	52	113	363
Tract 1238.01	4597	4470	72	8	31	16	132	3636	3546	47	6	25	12	97
Tract 1238.02	3906	3854	1	3	16	32	161	2983	2948	1	2	10	22	111
Tract 1239	4942	4833	34	0	44	31	238	3726	3658	19	0	28	21	174
Tract 1240.01	4651	4564	11	2	54	20	148	3565	3507	8	2	37	11	99
Tract 1240.02	3407	3357	11	1	26	12	131	2586	2556	7	1	13	9	97
Tract 1241.01	4433	4312	29	6	40	46	197	3374	3295	22	5	21	31	132
Tract 1241.02	3490	3432	1	2	39	16	129	2637	2595	1	2	26	13	87
Tract 1242	5937	5810	29	7	53	38	263	4512	4435	13	5	40	19	181
Tract 1243	6498	6138	192	8	97	63	329	5090	4835	136	6	71	42	217
Tract 1244.01	3661	3581	25	9	29	17	108	2966	2910	21	5	17	13	77
Tract 1244.02	3769	3736	5	2	22	4	105	2951	2928	3	2	14	4	71

SUFFOLK COUNTY POPULATION BY CENSUS TRACT - 1990

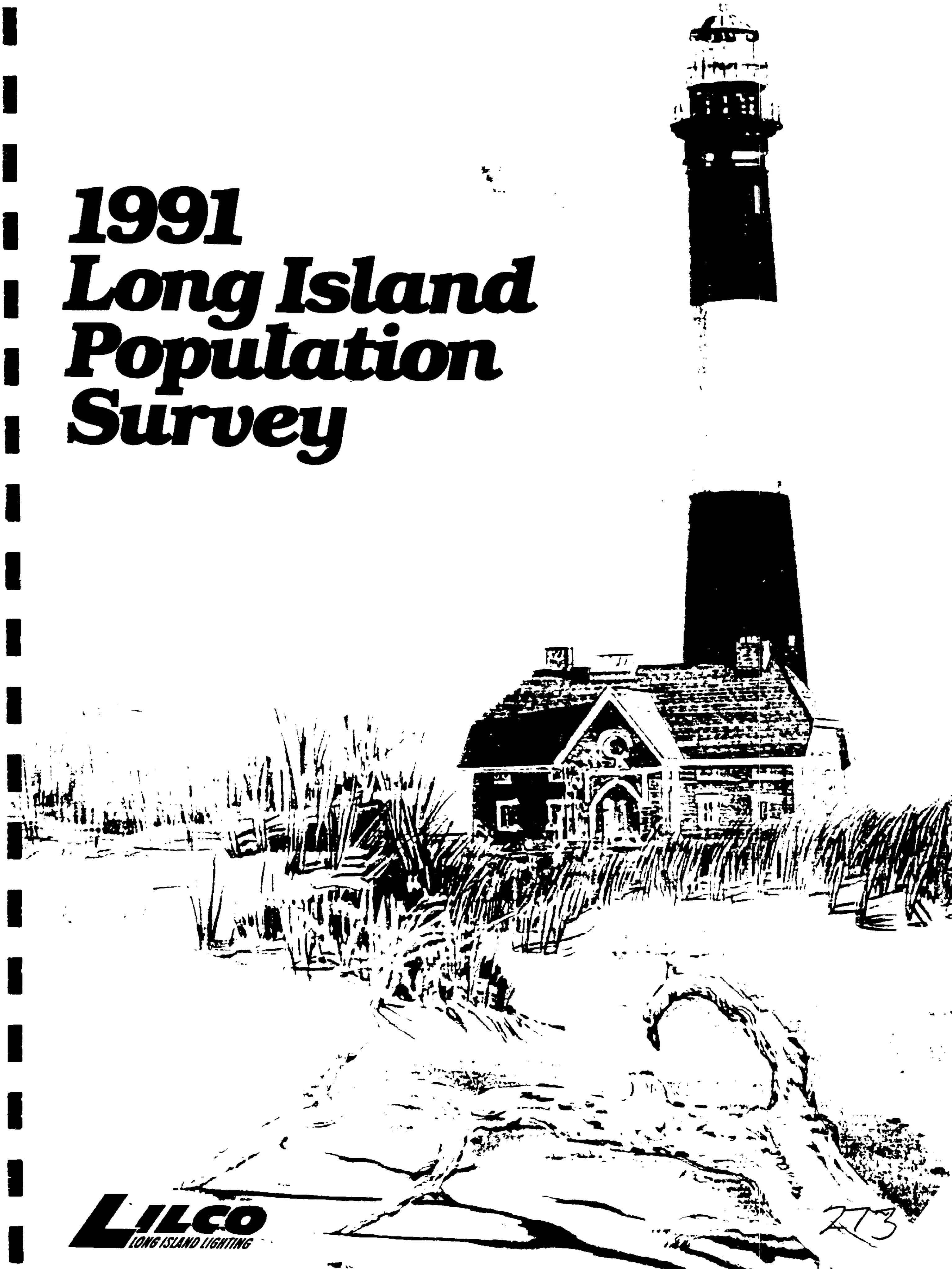
	Total	White	Black	Am Ind Eskimo Aleut	Asian Pacific Islander	Other	Hispanic	Total	White	Black	Am Ind Eskimo Aleut	Asian Pacific Islander	Other	Hispanic
								--------------Population 18 Years and Over------------------						
Tract 1246.01	2887	2843	12	3	25	4	61	2253	2223	9	3	15	3	47
Tract 1246.02	4394	4249	87	5	34	19	172	3486	3388	61	4	18	15	122
Tract 1347.02	5571	5430	34	2	79	26	134	4380	4277	24	2	58	19	89
Tract 1347.03	3574	3490	15	2	59	8	93	2797	2735	13	2	41	6	69
Tract 1347.04	2588	2466	34	2	72	14	92	1980	1885	27	2	55	11	68
Tract 1348	2073	1506	454	5	40	68	155	2048	1484	453	5	38	68	155
Tract 1349.02	4747	4613	15	1	107	11	119	3748	3640	13	1	86	8	88
Tract 1349.03	1312	1278	13	0	21	0	20	1002	977	11	0	14	0	13
Tract 1349.04	5875	5711	41	11	100	12	209	4556	4440	36	5	69	6	154
Tract 1349.05	4012	3955	18	1	30	8	81	3075	3032	12	1	22	8	59
Tract 1349.06	5526	5379	27	7	96	17	109	4331	4225	20	6	64	16	88
Tract 1350.02	5248	5136	26	3	69	14	118	3970	3891	23	2	44	10	79
Tract 1350.03	4007	3970	11	3	16	7	91	2983	2958	9	2	10	4	66
Tract 1350.04	2974	2924	10	3	36	1	80	2332	2289	10	3	29	1	58
Tract 1350.05	3449	3392	17	1	35	4	60	2932	2889	14	1	25	3	46
Tract 1351.01	3872	3734	37	3	94	4	117	3074	2980	28	1	62	3	90
Tract 1351.02	4142	3991	11	0	115	25	89	3186	3092	8	0	72	14	65
Tract 1351.03	5307	4992	77	4	213	21	128	3775	3575	51	2	140	7	98
Tract 1351.04	4754	4662	14	5	52	21	112	3563	3507	11	2	32	11	77
Tract 1352.01	2177	2130	6	0	39	2	42	1688	1653	6	0	28	1	33
Tract 1352.02	4640	4485	16	1	132	6	125	3699	3595	12	1	88	3	96
Tract 1352.04	4672	4556	7	0	98	11	88	3633	3552	5	0	67	9	72
Tract 1352.05	5241	5080	26	3	112	20	118	4101	3995	21	1	75	9	83
Tract 1352.06	1976	1903	21	0	43	9	45	1577	1517	18	0	35	7	35
Tract 1353.01	3429	3344	5	2	53	25	91	2617	2561	4	2	32	18	61
Tract 1353.03	3953	3887	8	0	45	13	81	3045	2992	7	0	36	10	66
Tract 1353.04	3287	3214	23	1	43	6	86	2642	2593	19	1	26	3	71
Tract 1354.01	4758	4652	21	0	81	4	122	3563	3495	18	0	47	3	84
Tract 1354.02	5954	5754	42	5	123	30	182	4303	4162	34	3	83	21	124
Tract 1354.03	4332	4208	23	5	86	10	148	3157	3078	14	5	50	10	105
Tract 1455	2278	1813	419	10	9	27	118	2270	1806	418	10	9	27	118
Tract 1456.01	4499	4007	206	8	103	175	766	3449	3123	129	8	67	122	551
Tract 1456.02	4683	3900	331	5	121	326	980	3549	3022	222	3	76	226	698
Tract 1456.03	5210	2644	1419	37	49	1061	3611	3553	1818	949	26	30	730	2480
Tract 1456.04	3321	2195	440	6	121	559	1294	2396	1641	297	4	77	377	894
Tract 1456.05	2712	2200	221	0	107	184	617	2068	1700	154	0	72	142	423
Tract 1457.01	5150	4872	129	1	112	36	245	4066	3865	97	1	76	27	182
Tract 1457.02	4515	3473	584	7	86	365	1577	3265	2585	385	5	59	231	1034
Tract 1457.03	4396	3219	619	9	75	474	1272	3152	2389	400	6	51	306	839
Tract 1457.04	6305	4705	865	22	130	583	1421	4647	3594	577	11	92	373	929
Tract 1458.03	4431	4209	80	6	102	34	183	3235	3086	63	2	59	25	127
Tract 1458.04	2809	2462	173	5	70	99	328	2061	1831	106	3	53	68	228
Tract 1458.05	5846	5671	39	7	80	49	238	4385	4268	28	6	53	30	142
Tract 1458.06	8267	8042	22	12	83	108	433	5957	5806	14	8	53	76	296
Tract 1459.01	3278	2735	306	7	56	174	527	2388	2028	202	5	43	110	326
Tract 1459.02	6218	4578	965	22	62	591	2087	4603	3486	654	14	42	407	1486
Tract 1459.03	5276	5078	92	6	35	73	402	3886	3747	58	5	21	55	283
Tract 1460.01	3649	2422	555	32	43	597	2119	2586	1744	374	18	25	425	1461

REFERENCE NO. 13



RESIDENT POPULATION CALCULATION

1991 Long Island Population Survey



LILCO
LONG ISLAND LIGHTING

POPULATION SURVEY
1991

Current Population Estimates
For Nassau And Suffolk Counties

Long Island Lighting Company
175 E. Old Country Road
Hicksville, New York 11801

August 1991

274

HOUSEHOLD SIZE

On January 1, 1991, the average household size in the Nassau—Suffolk area is estimated to be 2.98, a .01 decrease from the 2.99 persons per household reported for the bi-county area by the 1990 U.S. Census. This figure is still substantially above the national average, which was 2.63 in 1990.

While the average size of households has declined in both counties, the number of households has continued to increase. Both the decrease in household size, and the increase in the number of households are attributed in part to the growing number of one person households. This growing number is result of young adults setting up housekeeping away from their parents as well as divorced individuals setting up separate households. The number of retirement housing units such as those found in Leisure Village and similar complexes also contribute to a smaller overall household size. It does so by retaining population that might otherwise be lost to other areas of the State or Country. Another contributing factor to smaller household sizes has been the long term trend of fewer children per family.

Estimated Average Household Size by Major Municipality

	1980 Census	1990 Census	1991 Estimate
Nassau County	**3.08**	**2.94**	**2.93**
North Hempstead	2.93	2.80	2.79
Hempstead	3.10	2.99	2.98
Long Beach City	2.39	2.35	2.35
Oyster Bay	3.26	3.01	3.00
Glen Cove City	2.94	2.78	2.78
Suffolk County	**3.25**	**3.04**	**3.03**
Huntington	3.28	3.00	2.99
Babylon	3.29	3.10	3.09
Islip	3.42	3.26	3.26
Smithtown	3.53	3.10	3.08
Brookhaven	3.26	3.07	3.06
Riverhead	2.62	2.55	2.55
Southampton	2.51	2.41	2.41
Southold	2.54	2.42	2.41
East Hampton	2.41	2.32	2.32
Shelter Island	2.31	2.23	2.22
Queens County			
Rockaway Peninsula	3.02	2.88	2.88

275

REFERENCE NO. 14

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

CONTROL NO:	DATE: 2-10-92	TIME:

DISTRIBUTION:

Bethpage 3838-0101

BETWEEN:	OF:	PHONE:
Abe Kern	DPRO-Bethpage	(516) 575-6192

AND:

Dave Brayack - H-NUS

DISCUSSION:

Abe Kern called to furnish the following data regarding workers in sites 1, 2 & 3 at NWIRP Bethpage:

78 on-site workers total

Site 1 - 12 transients
Site 2 - 2 at salt shed/yard
Site 3 - 4 at treatment plant
60 at office building

RBates for D.B.

ACTION ITEMS:

277

NUS 067 REVISED 0685

REFERENCE NO. 7

R-49-2-92-1

FINAL
REMEDIAL INVESTIGATION REPORT
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

VOLUME I

PREPARED BY

HALLIBURTON NUS
ENVIRONMENTAL CORPORATION
PITTSBURGH, PENNSYLVANIA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY
(CLEAN) PROGRAM

CONTRACT NO. N62472-90-D-1298
CONTRACT TASK ORDER NUMBER 0003

MAY 1992

HALLIBURTON NUS
Environmental Corporation

Donohue ENGINEERS ARCHITECTS SCIENTISTS

ENSR

HALLIBURTON NUS
Environmental Corporation

661 ANDERSEN DRIVE · PITTSBURGH, PENNSYLVANIA 15220 (412) 921-7090

R-49-2-92-1

FINAL
REMEDIAL INVESTIGATION REPORT
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

Submitted to:
Northern Division
Environmental Branch, Code 1821/DF
Naval Facilities Engineering Command
Building 77-L, U.S. Naval Base
Philadelphia, Pennsylvania 19112-5094

Submitted by:
HALLIBURTON NUS Environmental Corporation
661 Andersen Drive
Pittsburgh, Pennsylvania 15220

Contract No. N62472-90-D-1298
Contract Task Order Number 0003

MAY 1992

SUBMITTED FOR HALLIBURTON NUS BY:

David D. Brayack

DAVID D. BRAYACK, P.E.
PROJECT MANAGER

APPROVED:

FOR JOHN J. TREPANOWSKI, P.E.
PROGRAM MANAGER

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLES | **PAGE**

TABLE OF CONTENTS (Cont'd)

FIGURES **PAGE**

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

FIGURES **PAGE**

EXECUTIVE SUMMARY

Purpose of Report

The work to be performed under Contract N62472-90-D-1298, Contrac Task Order (CTO) 0003, is to conduct a Remedial Investigation (RI at the Naval Weapons Industrial Reserve Plant (NWIRP), Bethpage New York.

This work is part of the Navy's Installation Restoration Program which is designed to identify contamination of Navy and Marin Corps lands/facilities resulting from past operations and t institute corrective measures, as needed.

Scope and Objectives

The overall objective of this RI is to characterize the nature an extent of potential environmental contamination and associate risks to human health and the environment at the NWIRP. The dat collected will also be used to evaluate potential remedial options. The specific objectives for the Bethpage activity are to identif the location and concentration of potential soil and groundwate contamination by solvents and metals at three sites identified i the Initial Assessment Study (IAS) and to determine whether thes sites are the source or one of the sources of an organic compoun contaminated groundwater plume in the Bethpage area. Simila investigations are currently underway at the Grumman Bethpage an RUCO Polymer Corporation (RUCO) facilities. Other potential sources of this contamination may exist.

Activity Background Information

The NWIRP is situated on 108 acres in Nassau County in the Hamlet of Bethpage, Town of Oyster Bay, New York. The NWIRP lies entirely within the Grumman Aerospace complex, which covers approximately 605 acres. The NWIRP is bordered on the north, west, and south by Grumman facilities, and on the east by a residential neighborhood.

The histories of the NWIRP and Grumman Aerospace facilities are discussed in detail in the Initial Assessment Study of the NWIRP and the RI/FS Work Plan for the Grumman facility prepared by Geraghty and Miller. The following synopsis is from those discussions.

The NWIRP was established in 1933. Since its inception, the plant's primary mission has been the research prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft.

The facilities at NWIRP include four plants (Nos. 3, 5, and 20, used for assembly and prototype testing; and No. 10, a group of quality control laboratories), two warehouse complexes (north and south), a salvage storage area, water recharge basins, the Industrial Wastewater Treatment Plant (to process chemical effluents from the activity's manufacturing operations), and several smaller support buildings.

An Initial Assessment Study (IAS) of NWIRP Bethpage, New York, and NWIRP Calverton, New York, conducted in 1986 indicated that three areas at the Bethpage Plant may pose a threat to human health or the environment. These three sites are Site 1 - Former Drum Marshaling Area, Site 2 - Recharge Basin Area, and Site 3 -Salvage Storage Area. Based on the historic data presented in the IAS, there is the potential for volatile organic, semivolatile organic, and inorganic contamination at each of the three sites.

Grumman Aerospace Corporation is conducting a parallel investigation at its facility. The purpose of the Grumman RI/FS was to execute a series of tasks that would lead to the identification and definition of potential contamination attributable to the Grumman facility and provide sufficient data for the conceptual design of a remedial action alternative (if needed) for the site. The Grumman RI/FS is being conducted in a phased approach. Phase 1 (the initial field investigation) was intended to define the nature and extent of potential onsite contamination attributable to the Grumman facility. Applicable results of the Phase 1 study have been included in this report. A work plan for the Phase 2 Remedial Investigations, which will address on- and off-site areas, was recently submitted to the NYDEC.

Geology/Hydrology

The NWIRP is underlain by approximately 1,100 feet of unconsolidated sediments that unconformably overlie crystalline bedrock. The unconsolidated sediments consist of four distinct geologic units that, in descending order, are the Upper Glacial Formation, the Magothy Formation, the Raritan Clay Member of the Raritan Formation, and the Lloyd Sand Member of the Raritan Formation. The crystalline bedrock consists primarily of schist, gneiss, and granite. The regional dip is to the south and southeast. All of the geologic units dip in these directions, although to varying degrees.

The Upper Glacial and the Magothy Formations were penetrated and sampled; the Raritan Formation lies below the total depth of this investigation. The Upper Glacial Formation, which is about 30 to 45 feet thick, consists chiefly of coarse sands and gravels. The upper Magothy Formation consists chiefly of coarse sands to a depth of about 100 feet, below which finer sands, silts, and clays predominate. The clay is fairly common but laterally discontinuous; no individual clay horizon of regional extent underlies the NWIRP.

The Upper Glacial Formation, the Magothy Formation, and the Lloyd Sand are regional aquifers. Because of their proximity to the land surface, the principal aquifers of concern in this investigation are the Upper Glacial and Magothy aquifers. Of these two aquifers, the Magothy aquifer is the major source of public water in Nassau County. Because of its depth the Lloyd Sand is not widely exploited. Furthermore, the Lloyd Sand is isolated from the shallower aquifers by the Raritan Clay confining unit.

The water table beneath the NWIRP occurred completely within the Magothy Formation in December 1991. The magnitude of the seasonal water-table fluctuation beneath the site is unknown, but it is unlikely that the water table rises to the Upper Glacial Formation. The high permeability of the glacial deposits, however, allows for the rapid recharge of precipitation to the underlying Magothy.

The geologic and hydrologic information obtained from this study indicates that the Upper Glacial and upper Magothy aquifers beneath the NWIRP are interconnected and may be considered a common aquifer. This confirms the theory that the site-specific geology is similar to the regional geology, as described in published reports. Groundwater in this aquifer occurs under water-table or unconfined conditions. The number and thickness of clay lenses increase with depth within the Magothy, but the horizontally discontinuous nature of these units prevents any one of them from singularly functioning as an aquitard or semiconfining unit.

The groundwater beneath the NWIRP dominantly flows to the southwest and, to a lesser extent, to the south. The flow is greatly influenced by the groundwater mounding that occurs at the recharge basins and by the groundwater withdrawal at the numerous facility wells. The wells have the potential to significantly change the local flow pattern. These wells operate on an irregular basis and in various combinations. Consequently, their influence on the local flow regime at any particular time is difficult to predict.

The horizontal hydraulic gradient varies throughout the NWIRP due to the recharge basins and facility wells. The average gradient calculated across the activity is about 5.3 feet/mile, which is significantly lower that the published regional gradient of 10 feet/mile. The average linear velocity of the groundwater at the water table is estimated to range from 0.2 ft/day to 0.9 ft/day, which is significantly less than the previously estimated 50 to 70 ft/day.

The NWIRP occupies an area of recharge. Vertical hydraulic gradients are in a downward direction, but are very low. This agrees with previously published regional data.

Site 1: Former Drum Marshaling Area

History

Starting in 1969, hazardous waste management practices for Grumman facilities on Long Island included marshaling of drummed wastes on the Navy property at NWIRP Bethpage. Such storage first took place on a cinder-covered surface over the cesspool field east of Plant 03. From the early 1950s through about 1978, drums containing liquid cadmium waste were stored here. In 1978, the collection and marshaling point was moved a few yards south of the original unpaved site, to an area on a 100- by 100-foot concrete pad. This pad had no cover, nor did it have berms for containment of spills. In 1982, drummed waste storage was transferred to the present Drum Marshaling facility, located in the Salvage Storage Area (Site 3); a cover was added in 1983.

Reportedly, all drums of waste marshaled at the Former Drum Marshaling Areas were taken off-activity by a private contractor for treatment or disposal. There are no reports of leaks or spills of drum contents.

Materials stored at the Former Drum Marshaling Areas included waste halogenated and nonhalogenated solvents. Cadmium and cyanide were also stored in this area from the early 1950s through 1974. Reportedly, 200 to 300 drums were stored at each area at any one time.

Field Activities

The field investigation consisted of collecting 32 soil-gas samples at 16 locations, 7 surface soil samples, 18 subsurface soil samples at 10 locations, and 10 temporary monitoring well samples; installing 7 permanent monitoring wells at 3 locations; and sampling 8 permanent monitoring wells.

All of the samples were analyzed for volatile organic constituents. The surface soil samples, shallow subsurface soil samples (less than 5 feet deep), surface water, sediment, and groundwater samples were analyzed for inorganic and semivolatile organic constituents. The groundwater samples were also analyzed for soluble inorganic constituents (less than 0.45 microns) and hexavalent chromium. In addition, subsurface soils that were observed to be oil stained were analyzed for PCBs and pesticides. Select soil and groundwater samples were analyzed for engineering-type parameters. For soil, these included total organic carbon (TOC), bulk density, grain size, moisture contents and pH. For groundwater, pH, total dissolved solids (TDS), alkalinity, hardness, biochemical oxygen demand (BOD_5), total organic carbon (TOC), and total suspended solids were analyzed.

Nature and Extent of Contamination

Volatile organic compound (VOC) contamination, especially by chlorinated ethanes and chlorinated ethenes, is evident in soil and groundwater. The highest concentrations at the NWIRP were reported in Site 1, especially near the drum marshaling areas. VOC contamination was greater in shallow wells than intermediate. VOC contamination was also greater in subsurface than in surface soil. PCBs were reported at various locations in soil.

Notable levels of certain inorganics, including chromium, arsenic, and cyanide, were detected in onsite media. Surface soil in Site 3 and subsurface soil in Site 2 exhibited the highest levels of inorganics. There is no clear pattern in the concentrations of inorganics in groundwater; notable levels of metals, including arsenic, vanadium, chromium, lead and cyanide, were reported in some wells.

Baseline Risk Assessment

To assess the risks to human health from the site contaminants, exposure scenarios were developed. For contaminated soil, the scenarios include direct contact with contaminants in surface soils through dermal contact, ingestion, and inhalation (current soil exposure); potential direct contact with subsurface soils following excavation of such soils; (future soil exposure); and indirect exposure through soil contaminants leaching to groundwater, and the contaminated groundwater being consumed (future groundwater exposure). The receptors include onsite adult workers and offsite adult and child residents. The receptors for direct contact were employees only. For the contaminated groundwater, the scenarios include residential and employee consumption of the contaminated groundwater (current groundwater exposure).

In general an acceptable range for carcinogenic risk (as defined by the NCP) ranges from 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1 million). Remedial alternatives should be designed to attain a 10^{16} risk level although factors related to exposure, uncertainty, and technical limitations may justify a deviation. For noncarcinogenic risks, a hazard index (HI) in excess of unity (1.0) reflects a potential health risk associated with exposure to a chemical mixture.

Hazard Indices calculated for current and future soil exposure are all below 1.0; adverse noncarcinogenic health effects for these pathways are not indicated. Total cancer risks for current soil exposure range from 2E-7 to 4E-6, with the highest risk occurring for the adult employee dermal exposure scenario. Aroclor 1248 in Site 1 was the major factor in these potential dermal cancer risks. Estimated total cancer risks for future soil exposure ranged from 9E-11 to 9E-6, with the highest risks occurring for the adult resident dust inhalation scenario at Site 1. Arsenic at Site 1 was primarily responsible for these projected cancer risks.

For potential exposure to current groundwater concentrations, Hazard Indices exceeded 1.0 for all three potential receptors (employee, adult resident, child resident). Individual Hazard Quotients for several chemicals exceeded 1.0, including both metals and VOCs. Estimated total cancer risks ranged from 8E-4 to 3E-3, with TCE risks comprising a large portion of the total risk.

For potential exposure to future groundwater concentrations, Hazard Indices exceeded 1.0 for the resident ingestion/dermal pathways. This was due primarily to PCE, for which the Hazard Quotient exceeded 1.0. Estimated total cancer risks ranged from 6E-6 to 6E-4, with TCE, PCE, and Aroclor 1248 posing the greatest risks.

Based on current risk assessment modeling, it has been determined that groundwater concentrations of VOCs and inorganics are the most significant sources of noncarcinogenic and carcinogenic risk at the Bethpage site. In addition, many groundwater constituents exceeded Federal and state drinking water standards. PCBs in surface and subsurface soil at Bethpage may pose the greatest cancer risk, especially because of their high CSF.

Conclusions

Based on volatile organic isoconcentration contour maps, Site 1 is a likely sources of on-site and near-site (Grumman) groundwater contamination. It is anticipated that additional work will be required to define the overall extent of contamination.

The soils at Site 1 contain sufficient residual volatile organic contamination to confirm the source of groundwater contamination as being near or at the former drum marshaling areas. Based on observed groundwater contamination patterns, there are potentially other source areas at the NWIRP including sumps and tanks at Plant 3 and a former coal storage pile near Plant 3.

The contaminants in the soils at the NWIRP (under the current or in future scenarios) do not represent a significant, direct, non-carcinogenic risk to onsite workers or offsite residents (hazard index is less than 1.0). Likewise, incremental carcinogenic risks are not indicated for offsite residents under the current soil scenario (excess cancer risk less than 1×10^{-6}). However, carcinogenic risks to onsite workers (under the current and future soil scenarios) and offsite residents (under future soil scenarios) exceed an excess cancer risk of 1×10^{-6}. The risks do not, however, exceed an excess cancer risk of 1×10^{-4}.

The groundwater at Bethpage, if used as a potable water source, would be expected to result in significant carcinogenic risks (excess cancer risk greater than 1×10^{-4}) and noncarcinogenic risks (hazard index greater 1.0) to residents and employees under the current and future groundwater scenarios. The one exception to this is that the hazard index to employees under the future groundwater exposure would be about 0.5.

Site 2: Recharge Basin Area

History

Surface water drainage on Long Island is, for the most part, locally controlled, with numerous recharge basins used to channel this resource back to the groundwater. Several such recharge basins are located at NWIRP Bethpage.

Prior to 1984, some Plant 03 production-line rinse waters were discharged to the recharge basins. The Environmental/Energy Survey of the activity, published in 1976, states that 1.85 million gallons per week were discharged to the recharge basins. These waters were directly exposed to chemicals used in industrial processes (involving the rinsing of manufactured parts). Reportedly, these discharges of dilute rinse waters did not contain chromates, based on the Initial Assessment Study (IAS).

Since about 1977, the discharge rate has been 14 million gallons per week of noncontact cooling water. All discharge currently goes to the Industrial Wastewater Treatment Plant.

Also, adjacent to the recharge basins are the former sludge drying beds. Sludge from the Plant 02 Industrial Waste Treatment Facility was dewatered in the drying beds before offsite disposal.

On at least one occasion, sampling performed by the Nassau County Department of Health detected levels of hexavalent chromium in excess of allowable limits. Grumman was notified of this noncompliance and asked to perform remedial actions necessary to eliminate the problem. Reportedly, Grumman complied with the request.

Contaminants of concern include hexavalent (and other valence) chromium, aluminum, nitric acid, and sulfuric acid.

Field Activities

The field investigation consisted of collecting 48 soil-gas samples at 24 locations, 13 surface soil samples, 14 subsurface soil samples at 13 locations, 11 temporary monitoring well samples, 2 surface water samples, and 4 sediment samples; installing 3 permanent monitoring wells at 2 locations; and sampling 3 permanent monitoring wells.

All of the samples were analyzed for volatile organics constituents. The surface soil samples, shallow subsurface soil samples (less than 5 feet deep), surface water, sediment, and groundwater samples were analyzed for inorganic and semivolatile organic constituents. The groundwater and surface water samples were also analyzed for soluble inorganic constituents (less 0.45 microns) and hexavalent chromium. In addition, surface and subsurface soils that were observed to be oil stained were analyzed for PCBs and pesticides. Select soil and groundwater samples were analyzed for engineering-type parameters.

Nature and Extent of Contamination

VOC contamination, especially by chlorinated ethanes and chlorinated ethenes, is present in soil, surface water, and groundwater. However, the concentrations detected at Site 2 are significantly lower than detected at Sites 1 and 3. Also, the upgradient monitoring wells at Site 2 were also observed to contain similar volatile organics. VOC contamination was also greater in subsurface than in surface soil. PCBs were reported at various locations in soil. Recharge basin surface water and sediment exhibited trace to low levels of VOCs.

Notable levels of certain inorganics, including chromium, arsenic, and cyanide, were detected in onsite media. Subsurface soil in Site 2 exhibited the highest levels of inorganics of the three sites. There is no clear pattern in the concentrations of inorganics in groundwater; notable levels of metals, including arsenic, vanadium, chromium, lead and cyanide, were reported in some wells.

Baseline Risk Assessment

To assess the risks to human health from the site contaminants, exposure scenarios were developed. For contaminated soil, the scenarios include direct contact with contaminants in surface soils through dermal contact, ingestion, and inhalation (current soil exposure); potential direct contact with subsurface soils following excavation of such soils; (future soil exposure); and indirect exposure through soil contaminants leaching to groundwater, and the contaminated groundwater being consumed (future groundwater exposure). The receptors include onsite adult workers and offsite adult and child residents. For the contaminated groundwater, the scenarios include residential and employee consumption of the contaminated groundwater (current groundwater exposure).

Hazard Indices calculated for current and future soil exposure are all below 1.0; adverse noncarcinogenic health effects for these pathways are not indicated. Total cancer risks for current soil exposure range from 5E-8 to 2E-6, with the highest risk occurring for the adult employee dermal exposure scenario. Aroclor 1248 in Site 2 was the major factors in these potential dermal cancer risks. Estimated total cancer risks for future soil exposure ranged from 5E-8 to 3E-6, with the highest risks occurring for the employee dermal absorption at Site 2. Aroclor 1248 at Site 2 wa primarily responsible for these projected cancer risks.

For potential exposure to current groundwater concentrations Hazard Indices exceeded 1.0 for all three potential receptor (employee, adult resident, child resident). Individual Hazar Quotients for several chemicals exceeded 1.0, including both metal and VOCs. Estimated total cancer risks ranged from 8E-4 to 3E-3 with TCE risks comprising a large portion of the total risk.

For potential exposure to future groundwater concentrations, Hazar Indices exceeded 1.0 for the resident ingestion/dermal pathways This was due primarily to PCE, for which the Hazard Quotien exceeded 1.0. Estimated total cancer risks ranged from 6E-6 t 6E-4, with TCE, PCE, and Aroclor 1248 posing the greatest risks.

Based on current risk assessment modeling, it has been determine that groundwater concentrations of VOCs and inorganics are the mos significant sources of noncarcinogenic and carcinogenic risk at th Bethpage site. In addition, many groundwater constituents exceede Federal and state drinking water standards. PCBs in surface an subsurface soil at Bethpage may pose the greatest cancer risk, especially because of their high CSF.

<u>Conclusions</u>

Based on volatile organic isoconcentration contour maps, Site 2 is not a likely source of onsite groundwater contamination.

Minimal volatile organic contamination of the soils or groundwater is present at Site 2. The surface water entering the recharge basins contains sufficient concentrations of volatile organics to result in groundwater contamination. However, the concentrations are not high enough to account for the volatile organic concentrations detected at Site 1. Based on the relative concentration of volatile organics found in the production wells, it is likely that the recharge basins are just redistributing the contaminated groundwater. Also, it should be noted that since the concentration of volatile organics in the surface water is lower than in the production wells, the systems likely to result in partial treatment of the groundwater by volatilization.

The contaminants in the soils at the NWIRP (under the current or in future scenarios) do not represent a significant, direct, non-carcinogenic risk to onsite workers or offsite residents (hazard index is less than 1.0). Likewise, incremental carcinogenic risks are not indicated for offsite residences under the current soil scenario (excess cancer risk less than 1×10^{-6}). However, carcinogenic risks to onsite workers (under the current and future soil scenarios) and offsite residents (under future soil scenarios) exceed an excess cancer risk of 1×10^{-6}. The risks do not, however, exceed an excess cancer risk of 1×10^{-4}.

The groundwater at Bethpage, if used as a potable water source, would be expected to result in significant carcinogenic risks (excess cancer risk greater than 1×10^{-4}) and noncarcinogenic risks (hazard index greater 1.0) to residents and employees under the current and future groundwater scenarios. The one exception to this is that the hazard index to employees under the future groundwater exposure would be about 0.5.

Site 3: Salvage Storage Area

History

The NWIRP Bethpage Salvage Storage Area is located north of the Plant 03. Fixtures, tools, and metallic wastes were stored here from the early 1950s through 1969, prior to recycling.

Stored materials included aluminum and titanium scraps and shavings. While in storage, cutting oils dripped from some of this metal. In 1985, IAS team members observed oil-stained ground at the site. However, soil tests performed by Grumman in 1984 revealed that oil stains were superficial; oil residues were not detected below the top several inches of soil material in the Salvage Storage Area at the locations tested.

About 1960, the Salvage Storage Area was reduced in size to accommodate parking. About 1970, it was reduced again for the same reason. Consequently, storage facility locations at this site have been periodically moved to accommodate changes in storage area size.

In addition to salvage storage, a 100- by 100-foot area within the boundary of the Salvage Storage Area was used for the marshaling of drummed waste. This area was covered with coal ash cinders. Drum marshaling continued here from the early 1950s to 1969. Wastes marshaled throughout the area included waste oils as well as waste halogenated and nonhalogenated solvents. The exact location of this former drum marshaling area is uncertain, however, it is suspected to be near the current drum marshaling area.

Potential contaminants of concern at Site 3 (from both drum marshaling and salvage storage) include cutting oils, aluminum, titanium, and halogenated and nonhalogenated solvents.

Field Activities

The field investigation consisted of collecting 60 soil-gas samples at 30 locations, 8 surface soil samples, 14 subsurface soil samples at 9 locations, and 9 temporary monitoring well samples; installing 5 permanent monitoring wells at 2 locations; and sampling 5 permanent monitoring wells and four production wells.

All of the samples were analyzed for volatile organic constituents. The surface soil samples, shallow subsurface soil samples (less than 5 feet deep), surface water, sediment, and groundwater samples were analyzed for inorganic and semivolatile organic constituents. The groundwater and production well samples were also analyzed for soluble inorganic constituents (less 0.45 microns) and hexavalent chromium. In addition, surface and subsurface soils that were observed to be oil stained were analyzed for PCBs and pesticides. Select soil and groundwater samples were analyzed for engineering-type parameters.

Nature and Extent of Contamination

VOC contamination, especially by chlorinated ethanes and chlorinated ethenes, is evident in soil and groundwater. One well, HN24I, located southwest of Site 3, exhibited a significant concentration of TCE. VOCs were detected in groundwater at greater concentrations south of Site 3 than north. However, these contaminant concentrations were less than those at Site 1. With the exception of HN24I, VOC contamination was greater in shallow wells than intermediate. VOC contamination was also greater in subsurface than in surface soil. PCBs were reported at various locations in soil.

Notable levels of certain inorganics, including lead, arsenic, and cyanide, were detected in onsite media. Surface soil in Site 3 exhibited the highest levels of inorganics for the three sites. There is no clear pattern in the concentrations of inorganics in groundwater; notable levels of metals, including arsenic, vanadium, chromium, lead and cyanide, were reported in some wells.

Baseline Risk Assessment

To assess the risks to human health from the site contaminants, exposure scenarios were developed. For contaminated soil, the scenarios include direct contact with contaminants in surface soils through dermal contact, ingestion, and inhalation (current soil exposure); potential direct contact with subsurface soils following excavation of such soils; (future soil exposure); and indirect exposure through soil contaminants leaching to groundwater, and the contaminated groundwater being consumed (future groundwater exposure). The receptors include onsite adult workers and offsite adult and child residents. For the contaminated groundwater, the scenarios include residential and employee consumption of the contaminated groundwater (current groundwater exposure).

Hazard Indices calculated for current and future soil exposure are all below 1.0; adverse noncarcinogenic health effects for these pathways are not indicated. Total cancer risks for current soil exposure range from 6E-8 to 2E-6, with the highest risk occurring for the adult employee dermal exposure scenario. Benzo[a]pyrene in Site 3 was the major factors in these potential dermal cancer risks.

For potential exposure to current groundwater concentrations, Hazard Indices exceeded 1.0 for all three potential receptors (employee, adult resident, child resident). Individual Hazard Quotients for several chemicals exceeded 1.0, including both metals and VOCs. Estimated total cancer risks ranged from 8E-4 to 3E-3, with TCE risks comprising a large portion of the total risk.

For potential exposure to future groundwater concentrations, Hazard Indices exceeded 1.0 for the resident ingestion/dermal pathways. This was due primarily to PCE, for which the Hazard Quotient exceeded 1.0. Estimated total cancer risks ranged from 6E-6 to 6E-4, with TCE, PCE, and Aroclor 1248 posing the greatest risks.

Based on current risk assessment modeling, it has been determined that groundwater concentrations of VOCs and inorganics are the most significant sources of noncarcinogenic and carcinogenic risk at the Bethpage site. In addition, many groundwater constituents exceeded Federal and state drinking water standards. PCBs in surface and subsurface soil at Bethpage may pose the greatest cancer risk, especially because of their high CSF.

Conclusions

Based on volatile organic isoconcentration contour maps, Site 3 is a likely source of onsite groundwater contamination. It is anticipated that the work associated with Site 1-related groundwater will define the extent of this contamination.

Only low concentrations of volatile organics were detected in the soils at Site 3. Therefore, the source area of the volatile organic plume either is no longer present or was not found during the RI.

Based on the relative concentration of volatile organics found in the production wells, the recharge basins are likely to be redistributing the contaminated groundwater. Also, it should be noted that since the concentration of volatile organics in the surface water is lower than in the production wells, the system is likely to result in partial treatment of the groundwater by volatilization.

The contaminants in the soils at the NWIRP (under the current or in future scenarios) do not represent a significant, direct, non-carcinogenic risk to onsite workers or offsite residents (hazard index is less than 1.0). Likewise, incremental carcinogenic risks are not indicated for offsite residences under the current soil scenario (excess cancer risk less than 1×10^{-6}). However, carcinogenic risks to onsite workers (under the current and future soil scenarios) and offsite residents (under future soil scenarios) exceed an excess cancer risk of 1×10^{-6}. The risks do not, however, exceed an excess cancer risk of 1×10^{-4}.

The groundwater at Bethpage, if used as a potable water source would be expected to result in significant carcinogenic risks (excess cancer risk greater than 1×10^{-4}) and noncarcinogenic risks (hazard index greater 1.0) to residents and employees under the current and future groundwater scenarios. The one exception to this is that the hazard index to employees under the future groundwater exposure would be about 0.5.

1.0 INTRODUCTION

1.1 Purpose of Report

The work to be performed under Contract N62472-90-D-1298, Contract Task Order (CTO) 0003, is to conduct a Remedial Investigation (RI) at the Naval Weapons Industrial Reserve Plant (NWIRP), Bethpage, New York.

This work is part of the Navy's Installation Restoration Program, which is designed to identify contamination of Navy and Marine Corps lands/facilities resulting from past operations and to institute corrective measures, as needed. There are typically four distinct phases. Phase 1 is the Preliminary Assessment (formerly known as the Initial Assessment Study). Phase 2 is a Site Investigation, which augments the information collected in the Preliminary Assessment. Phase 3 is the Remedial Investigation/ Feasibility Study (RI/FS), which characterizes the contamination at a facility and develops options for remediating the site. Phase 4 is the Remedial Action, which results in the control or cleanup of contamination at sites. This report was prepared under Phase 3 (RI/FS).

1.2 Scope and Objectives

The overall objective of this RI is to characterize the nature and extent of potential environmental contamination and associated risks to human health and the environment at the NWIRP. The data collected will also be used to evaluate potential remedial options. The specific objectives for the Bethpage activity are to identify the location and concentration of potential soil and groundwater contamination by solvents and metals at three sites identified in the Initial Assessment Study (IAS) (RGH 1986) and to determine whether these sites are the source or one of the sources of an organic compound contaminated groundwater plume in the Bethpage area. Similar investigations are currently under way at the Grumman Bethpage and RUCO Polymer Corporation (RUCO) facilities. Other potential sources of this contamination may exist.

1.3 Activity Background Information

1.3.1 Activity Location and Description

The NWIRP is situated on 108 acres in Nassau County in the Hamlet of Bethpage, Town of Oyster Bay, New York (see Figure 1-1). The NWIRP lies entirely within the Grumman Aerospace complex, which covers approximately 605 acres (see Figure 1-2). The NWIRP is bordered on the north, west, and south by Grumman facilities, and on the east by a residential neighborhood.

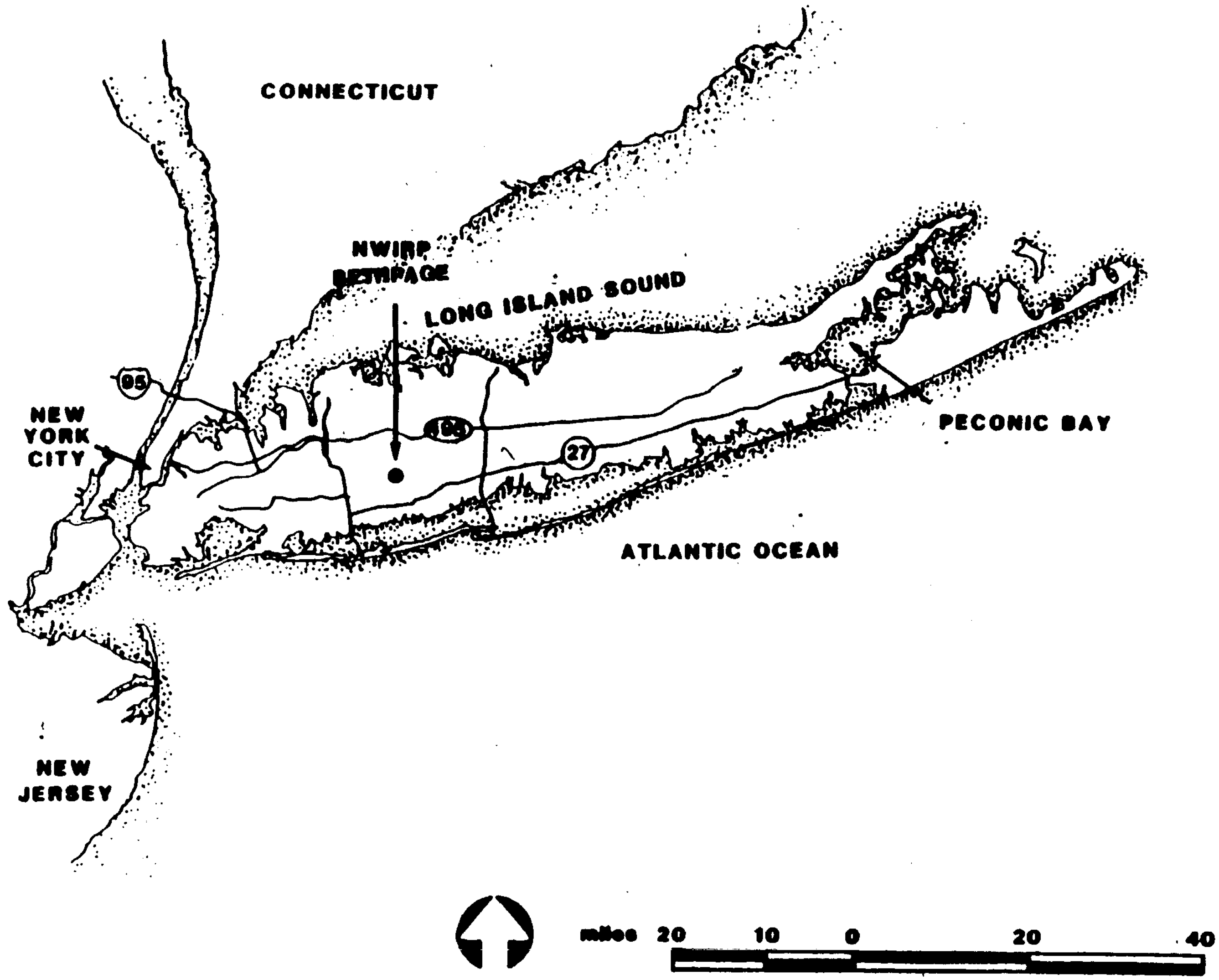


Figure 1–1

General Location Map,
NWIRP Bethpage, New York

Naval Weapons Industrial
Reserve Plant
Bethpage
Long Island, New York

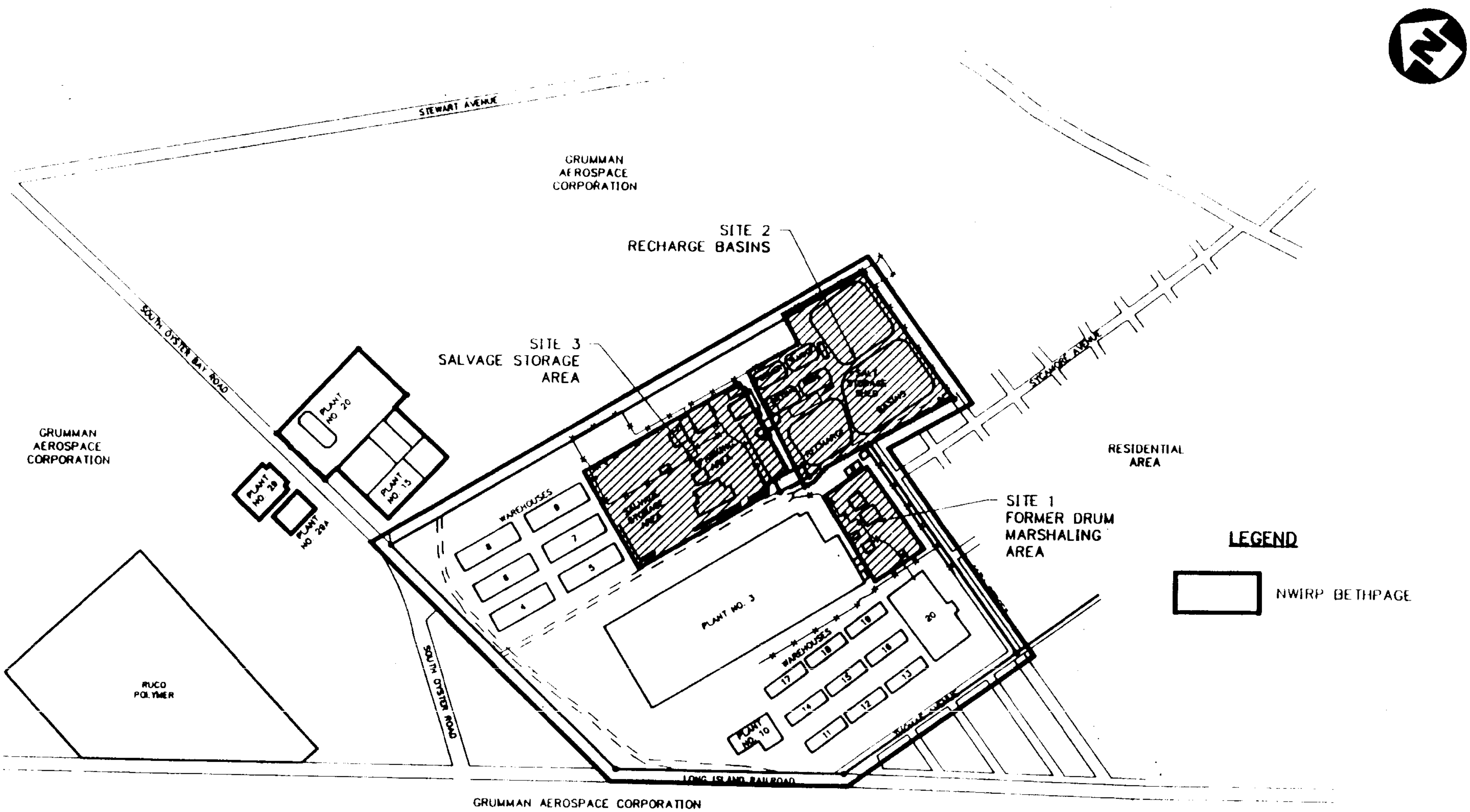


FIGURE 1-2

ACTIVITY LAYOUT
REMEDIAL INVESTIGATION

0 500 1000
SCALE IN FEET

HALLIBURTON NUS

The climate at NWIRP is described as a fairly humid, modified continental climate. The nearby Atlantic Ocean and Long Island Sound tend to reduce the temperature range commonly encountered further inland. The highest monthly mean temperature occurs in July (74.9 degrees); the lowest occurs in January (31.4 degrees). The mean annual precipitation is 45 inches, and the mean annual evapotranspiration is about 22 inches (RGH, 1986).

1.3.2 Activity History

The histories of the NWIRP and Grumman Aerospace facilities are discussed in detail in the Initial Assessment Study of the NWIRP and the RI/FS Work Plan for the Grumman facility prepared by Geraghty and Miller (G&M, 1990). The following synopsis is from those discussions.

The NWIRP was established in 1933. Since its inception, the plant's primary mission has been the research prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft.

The facilities at NWIRP (see Figure 1-3) include four plants (Nos. 3, 5, and 20, used for assembly and prototype testing; and No. 10, a group of quality control laboratories), two warehouse complexes (north and south), a salvage storage area, water recharge basins, the Industrial Wastewater Treatment Plant (to process chemical effluents from the activity's manufacturing operations), and several smaller support buildings.

An Initial Assessment Study (IAS) of NWIRP Bethpage, New York, and NWIRP Calverton, New York, conducted in 1986 (RGH, 1986) indicated that three areas at the Bethpage Plant may pose a threat to human health or the environment. These three sites are Site 1 - Former Drum Marshaling Area (identified as Site 7 in the IAS), Site 2 - Recharge Basin Area (identified as Site 8 in the IAS), and Site 3 - Salvage Storage Area (identified as Site 9 in the IAS). (These sites were renumbered to avoid confusion with the site designations at the Calverton Plant.) Figure 1-3 presents the location and general layout of the three sites at Bethpage.

Based on the historic data presented in the IAS, there is the potential for volatile organic, semivolatile organic, and inorganic contamination at each of the three sites. Also, although there are no historical records, there is the potential that transformers (containing possibly PCBs) may have been stored at the sites based on transformers observed by HALLIBURTON NUS during a site visit. It is unknown whether or not the transformers were properly drained prior to storage.

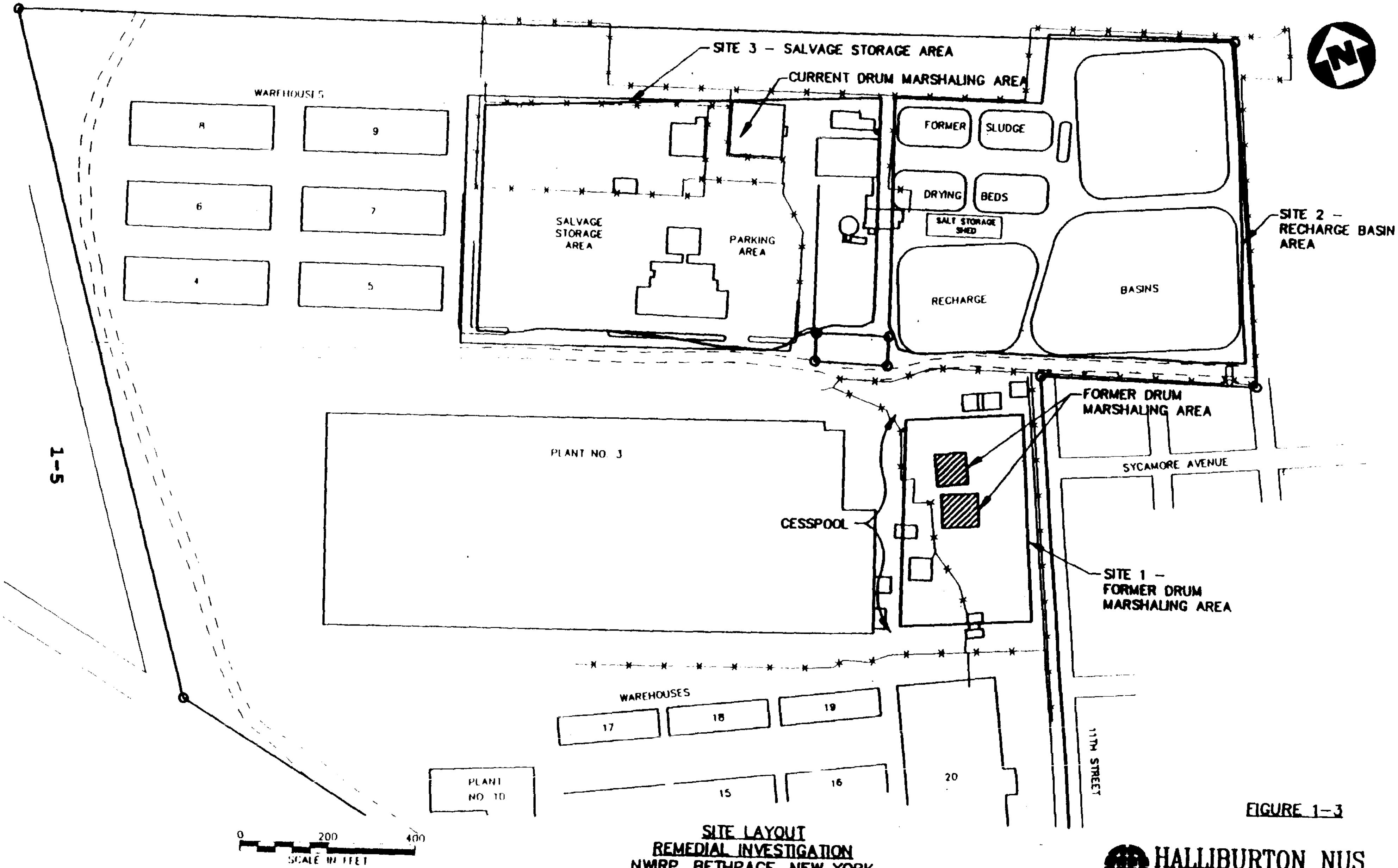


FIGURE 1-3

SITE LAYOUT
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

1.3.3 Site Description

1.3.3.1 Site 1: Former Drum Marshaling Area

Starting in 1969, hazardous waste management practices for Grumman facilities on Long Island included marshaling of drummed wastes on the Navy property at NWIRP Bethpage. Such storage first took place on a cinder-covered surface over the cesspool field east of Plant 03 (See Figure 1-3). From the early 1950s through about 1978, drums containing liquid cadmium waste were stored here. In 1978, the collection and marshaling point was moved a few yards south of the original unpaved site, to an area on a 100- by 100-foot concrete pad. This pad had no cover, nor did it have berms for containment of spills. In 1982, drummed waste storage was transferred to the present Drum Marshaling facility, located in the Salvage Storage Area (Site 3); a cover was added in 1983.

Reportedly, all drums of waste marshaled at the Former Drum Marshaling Areas were taken off-activity by a private contractor for treatment or disposal. There are no reports of leaks or spills of drum contents.

Materials stored at the Former Drum Marshaling Areas included waste halogenated and nonhalogenated solvents. Cadmium and cyanide were also stored in this area from the early 1950s through 1974. Reportedly, 200 to 300 drums were stored at each area at any one time.

1.3.3.2 Site 2: Recharge Basin Area

Surface water drainage on Long Island is, for the most part, locally controlled, with numerous recharge basins used to channel this resource back to the groundwater. Several such recharge basins are located at NWIRP Bethpage (See Figure 1-3).

Prior to 1984, some Plant 03 production-line rinse waters were discharged to the recharge basins. The Environmental/Energy Survey of the activity, published in 1976, states that 1.85 million gallons per week were discharged to the recharge basins. These waters were directly exposed to chemicals used in industrial processes (involving the rinsing of manufactured parts). Reportedly, these discharges of dilute rinse waters did not contain chromates. Halogenated and nonhalogenated solvents may have been present in the rinse waters discharge to the recharge basins.

Since about 1977, the discharge rate has been 14 million gallons per week of noncontact cooling water. All discharge currently goes to the Industrial Wastewater Treatment Plant.

Also, adjacent to the recharge basins are the former sludge drying beds. Sludge from the Plant 02 Industrial Waste Treatment Facility was dewatered in the drying beds before offsite disposal.

On at least one occasion, sampling performed by the Nassau County Department of Health detected levels of hexavalent chromium in excess of allowable limits (RGH, 1986). Grumman was notified of this noncompliance and asked to perform remedial actions necessary to eliminate the problem. Reportedly, Grumman complied with the request.

Contaminants of concern include hexavalent (and other valence) chromium, aluminum, nitric acid, and sulfuric acid.

1.3.3.3 Site 3: Salvage Storage Area

The NWIRP Bethpage Salvage Storage Area is located north of the Plant 03 (see Figure 1-3). Fixtures, tools, and metallic wastes were stored here from the early 1950s through 1969, prior to recycling.

Stored materials included aluminum and titanium scraps and shavings. While in storage, cutting oils dripped from some of this metal. In 1985, IAS team members observed oil-stained ground at the site. However, soil tests performed by Grumman in 1984 revealed that oil stains were superficial; oil residues were not detected below the top several inches of soil material in the Salvage Storage Area at the locations tested (RGH, 1986).

About 1960, the Salvage Storage Area was reduced in size to accommodate parking. About 1970, it was reduced again for the same reason. Consequently, storage facility locations at this site have been periodically moved to accommodate changes in storage area size.

In addition to salvage storage, a 100- by 100-foot area within the boundary of the Salvage Storage Area was used for the marshaling of drummed waste. This area was covered with coal ash cinders. Drum marshaling continued here from the early 1950s to 1969. Wastes marshaled throughout the area included waste oils as well as waste halogenated and nonhalogenated solvents. The exact location of this former drum marshaling area is uncertain, however, it is suspected to be near the current drum marshaling area.

Potential contaminants of concern at Site 3 (from both drum marshaling and salvage storage) include cutting oils, aluminum, titanium, and halogenated and nonhalogenated solvents.

1.4 Summary of Grumman RI/FS Activities

1.4.1 Previous Grumman Investigations

The two media which are potentially contaminated at the NWIRP Bethpage are soil and groundwater. No data are available on the potential soil contamination. However, there is a significant amount of data available on regional groundwater contamination (G&M, 1990). The Grumman Work Plan presents results of volatile organic testing of groundwater from monitoring wells within a 3-mile radius of the activity. The sample dates varied from 1982 to 1989. The location of the wells, a description of the wells, and the detailed analytical data are presented in Appendix A. The five volatile organics detected in the groundwater at the highest concentrations and greater frequency are as follows:

MAXIMUM VOLATILE ORGANIC CONCENTRATIONS IN GROUNDWATER

Parameter	Concentration (ug/l)	Location
Trichloroethene	1,600	Well 7635
Tetrachloroethene	2,400	Well 10595
1,1,1-Trichloroethane	650	Well 10595
1,1-Dichloroethane	160	Well 10595
1,2-Dichloroethane	340	Well 10629

Wells 10595 and 10629 are located about 800 feet south of Site 1; Well 7635 is located about 1300 feet southwest of Site 3 (See Figure 1-4). Analytical data on wells located on or near the Navy property are summarized as follows:

GROUNDWATER ANALYTICAL DATA
FOR WELLS ON THE NWIRP
MAXIMUM CONCENTRATIONS (ug/l)

Parameter	Well 10623 (USGS Well)	Well 7637	Well 7636	Well 10625	Well 8816	Well 7535	Well 8643	Well 10594
Screened Interval (ft)	68-72	-	-	-	-	-	-	73-76
Trichloroethene	580	14	54	120	35	150	37	440
Tetrachloroethene	550	6	5	25	6	160	120	ND
1,1,1-Trichloroethane	260	2	9	31	4	130	1	4
Vinyl Chloride	21	1	3	1	4	4	3	1
1,1-Dichloroethane	26	ND	ND	2	ND	ND	ND	ND
1,1-Dichloroethene	38	ND	ND	ND	ND	-	-	ND
1,2-Dichloroethene	130	ND	ND	ND	ND	-	-	ND

ND: None detected -: Indicates that data are not available

There are currently analytical data on only one additional groundwater well located within 1000 feet north of the Navy property. (Well 8454 is believed to be hydraulically upgradient of the NWIRP.) This well was found to have low (less than 10 ug/l) or nondeductible concentrations of volatile organics.

Only minimal data were available on potential metal and semivolatile organic contamination in the groundwater. In 1956, the recharge basin water for Plant No. 3 was measured to contain 0.24 parts per million (ppm) of hexavalent chromium and 0.04 ppm of cadmium.

1.4.2 Grumman RI/FS Activities

The RI/FS currently underway at the Grumman Bethpage facility is consistent with USEPA guidance documents, NYDEC policies, the NCP, and is being overseen by the NYDEC. The purpose of the Grumman RI/FS was to execute a series of tasks that would lead to the identification and definition of potential contamination attributable to the Grumman facility and provide sufficient data for the conceptual design of a remedial action alternative (if needed) for the site. The Grumman RI/FS is being conducted in a phased approach. Phase 1 (the initial field investigation) was intended to define the nature and extent of potential onsite contamination attributable to the Grumman facility. Applicable results of the Phase 1 study have been included in this report. A work plan for the Phase 2 Remedial Investigation, which will address on-site and off-site areas, was recently submitted to the NYDEC.

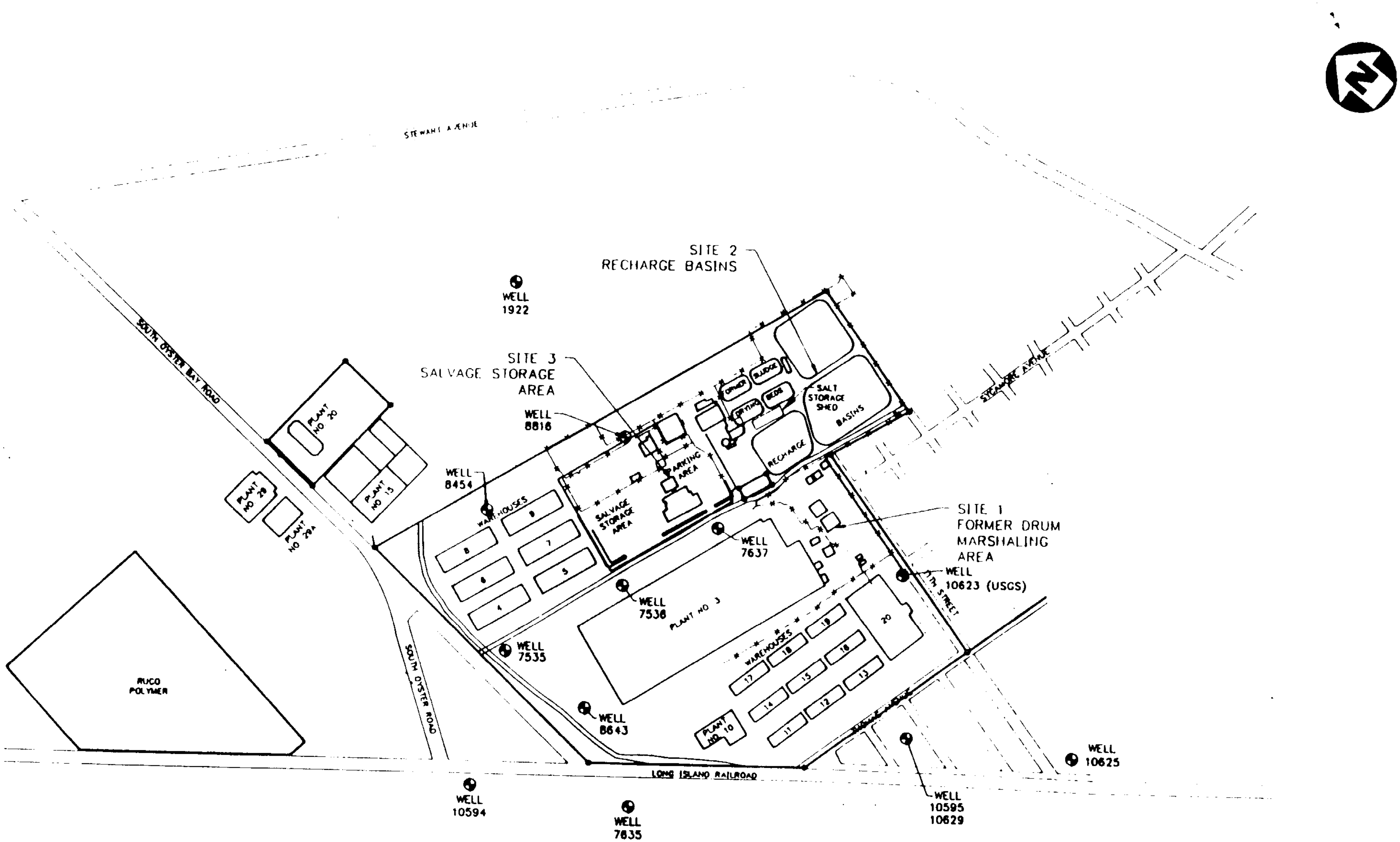


FIGURE 1-4

LOCATION OF EXISTING REGIONAL GROUNDWATER WELLS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation

Phase 1 included a limited soil-gas survey, collection and analysis of water and bottom-sediment samples from four of the seven south recharge basins, installation and/or sampling of several shallow soil borings (3 locations) and monitoring well clusters (new and existing - 23 locations), and measurement of onsite water levels (23 locations). Phase 2 will include drilling, installing, and sampling of additional on- and/or offsite borings and monitoring wells. The location of these sampling activities is presented in Appendix A.

Three of the Grumman well clusters are located north of Site 2 and Site 3, (GM-6, GM-7, and GM-8). These well clusters were used for upgradient wells for the NWIRP.

1.5 Report Organization

This report consists of seven sections. Section 1.0 is this introduction. Section 2.0 presents a description of the field activities. Section 3.0 provides the site geology and hydrogeology. Section 4.0 presents a description of the nature and extent of contamination. Section 5.0 describes the contaminant fate and transport data. Section 6.0 provides a baseline risk assessment. Section 7.0 provides the summary of the findings and conclusions.

2.0 FIELD PROGRAM DESCRIPTIONS AND RATIONALE

This section presents the basis for the RI scoping and a description of each of the field investigation tasks performed at the NWIRP Bethpage to meet the objectives of the RI.

Between August 19, 1991, and January 29, 1992, the following field activities were conducted:

- Soil-gas survey and analysis of samples at 73 locations (Section 2.2).
- Drilling and installation of 29 temporary wells and sampling and analysis of the groundwater (Section 2.3).
- Sampling and analysis of 48 subsurface soil samples at 29 locations and 29 surface soil locations (Section 2.4).
- Drilling and installation of 17 monitoring wells (Section 2.5).
- Groundwater sampling and analysis from selected existing monitoring and production wells and newly installed monitoring wells (Section 2.6).
- Surface water and sediment sampling and analysis from existing recharge basins (Section 2.7).
- Water-level measurements of groundwater obtained from monitoring wells (Section 2.8).
- Surveying the locations and vertical elevations of all newly installed monitoring wells, a USGS well, and soil-gas points (Section 2.9).

2.1 Scoping of Remedial Investigation

This section presents the data limitations and requirements, and data quality objectives.

2.1.1 Data Limitations and Requirements

The existing analytical data focused on volatile organic contamination in groundwater on a regional basis; there were no data available for soil contamination.

Additional data was required to identify the nature and extent of soil and groundwater contamination on the NWIRP and to assess risks to human health and the environment. To identify the nature and extent of contamination, analytical testing of surface and subsurface soils, recharge basin water and sediment, and groundwater was required. The history of the sites indicated that there was the potential for these media to be contaminated with volatile organics, semivolatile organics, metals, and cyanide. Also, there was the potential for PCBs and pesticides to be present in the soils.

A preliminary assessment of risk to human health and the environment at the NWIRP Bethpage site revealed two potential exposure scenarios: (1) direct contact of contaminated media by activity personnel and (2) contaminant migration within the groundwater. The direct contact risks can occur as a result of accidental ingestion of contaminated soils or groundwater, and inhalation of dust or organics volatilized from groundwater. The contaminant migration occurs as a result of precipitation infiltration contacting contaminated soils and leaching contaminants into the groundwater, recharge basin water discharge to groundwater and interactions with potentially contaminated sediments, and groundwater migration.

Since there was minimal data available regarding the source and location of potential soil and groundwater contamination, a phased approach was planned to optimize soil and groundwater testing efforts. To accomplish this, three phases were used. These phases overlapped to minimize schedule delays. The first phase consists of site-wide soil-gas survey coupled with the use of a field gas chromatograph (GC) to initially identify potential areas of subsurface soil and/or groundwater contamination. The second phase constituted the collection of groundwater samples for field GC analysis and soil samples for fixed-base laboratory analysis. The field GC groundwater analysis results were used to select the location of the permanent groundwater monitoring wells. The soil samples were used to quantify soil contamination. The third phase consists of collecting groundwater samples for fixed-base laboratory analysis to quantify groundwater contamination. During the third phase, sampling and analysis of the Recharge Basins sediment and surface water, wastes at the former sludge drying beds (if present), and surface soils were conducted to characterize the potential contamination of these media. The basis for selecting the fixed-base analytical parameters for each media is presented in Table 2-1.

Additional data were required regarding groundwater flow patterns at the NWIRP and interaction of groundwater with the surrounding areas. To accomplish this, water-level measurements and pumping/ slug tests are typically required. The water-level measurements are being conducted at the adjacent Grumman Plant and should be applicable to the NWIRP; however, additional measurements at the NWIRP was required. The pump tests will be conducted later if necessary.

TABLE 2-1

BASIS OF ANALYTICAL TESTING
NWIRP, BETHPAGE, NEW YORK

Site	Sample Type	Number of Samples	Rationale
1	Soils	Five to ten borings located in the field based on the results of the soil-gas testing with one to two samples per boring. Samples were collected at depths where elevated soil-gas readings were detected. Sample depths were be at 5 feet and/or 21 feet. Surface samples were collected in a grid pattern with two additional samples selected, based on apparent visual contamination. Analysis: TCL VOA on all samples plus SVOA, TCL metals, and cyanide on samples collected at the surface and at a depth of 5 feet. TCL PCBs and pesticides were also conducted on visually stained soils. CLP procedures were used.	Site 1 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Transformers (possibly PCB-filled) and pesticides may also have been stored at the area. It is unknown whether or not transformers were properly drained prior to storage. Residual soil contamination may remain at the site. Two of the samples were tested for the general engineering/ remediation parameters of TOC, bulk density, grain size, moisture content, and pH.
	Groundwater	Three well clusters located in the field based on soil-gas and temporary monitoring well testing with two to three wells per cluster and one sample per well. Well clusters were located along the hydraulic upgradient and downgradient borders of the site. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 1 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Any potential spills may have migrated to the groundwater. One sample was analyzed for the general engineering/remediation parameters of TDS, alkalinity, hardness, BOD, TOC, and TSS.
2	Soils	Five to ten borings located in the field based on the results of the soil-gas testing with one to two samples per boring. Samples were collected at depths where elevated soil-gas readings were detected. Sample depths were at 5 feet and/or 21 feet. Surface samples were collected in a grid pattern with two additional samples selected, based on apparent visual contamination. Analysis: TCL VOA on all samples plus SVOA, TCL metals, and cyanide on samples collected at the surface and at a depth of 5 feet. TCL PCBs and pesticides were also conducted on visually stained soils. CLP procedures were used.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant waste waters and sludges. These sludges were dried on site prior to offsite disposal. Transformers (possibly PCB-filled) and pesticides may also have been stored at the area. It is unknown whether or not transformers were properly drained prior to storage. Residual soil contamination may remain at the site. Two of the samples were tested for the general engineering/ remediation parameters of TOC, bulk density, grain size, moisture content, and pH.

TABLE 2-1
BASIS OF ANALYTICAL TESTING
NWIRP, BETHPAGE, NEW YORK
PAGE TWO

Site	Sample Type	Number of Samples	Rationale
2 (cont'd)	Groundwater	Two well clusters located in the field based on soil-gas and temporary monitoring well testing with one to two wells per cluster and one sample per well. Well clusters were located along the hydraulic upgradient and downgradient borders of the site. A Grumman well cluster was used as an additional upgradient data point, and a Site 1 well cluster were used as an additional down gradient data point. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant waste waters and sludges. These sludges were dried on site prior to off site disposal. Any releases of contaminants may have migrated to the groundwater. One sample was analyzed for the general engineering/remediation parameters of TDS, alkalinity, hardness, BOD, TOC, and TSS.
	Surface Water	Collect two surface water samples from the influent to the operating basin. One sample was collected during normal operations, and one sample was collected during a precipitation event. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant waste waters and sludges. These sludges were dried on site prior to offsite disposal. Currently it is reported that this water is noncontact; however, this classification needs to be confirmed. The precipitation event sample would be collected to determine whether contaminated runoff is entering the basins.
	Sediment	Sample each active recharge basins with two samples per basin. Only two of the three recharge basins were active during the RI. Analysis: TCL VOA and SVOA, TCL metals, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant wastewaters and sludges. These sludges were dried on site prior to offsite disposal. These sediments may be contaminated from past practices or from periodic current contamination.
	Waste	If encountered during drilling activities, one sample of the waste was to be obtained from the former sludge-drying areas. No waste materials were encountered during the RI. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	Site 2 was used to treat and discharge production wastewaters. Halogenated and nonhalogenated solvents, metals, and cyanide may have been present in the treatment plant wastewaters and sludges. These sludges were dried on site prior to offsite disposal. There is no evidence that the sludges remain at the site; however, if during the drilling program sludges are encountered, they will be sampled.

TABLE 2-1
BASIS OF ANALYTICAL TESTING
NWIRP, BETHPAGE, NEW YORK
PAGE THREE

Site	Sample Type	Number of Samples	Rationale
3	Soils	Five to ten borings located in the field based on the results of the soil-gas testing with one to two samples per boring. Samples were collected at depths where elevated soils gas readings were detected. Sample depths were at 5 feet and/or 21 feet. Surface samples were collected in a grid pattern with two additional samples selected, based on apparent visual contamination. Analysis: TCL VOA on all samples plus SVOA, TCL metals, and cyanide on samples collected at the surface and at a depth of five feet. TCL PCBs and pesticides were also conducted on visually stained soils. CLP procedures were used.	Site 3 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Site 3 was also used to store fixtures, tools, and metallic wastes. There are also reports of surface oil contamination. Transformers (possibly PCB-filled) and pesticides may also have been stored at the area. It is unknown whether or not transformers were properly drained prior to storage. Residual soil contamination may remain at the site. Two of the samples were tested for the general engineering/ remediation parameters of TOC, bulk density, grain size, moisture content, and pH.
	Groundwater	Three well clusters. One well cluster was located southwest of Plant 3. This well point was used to fill in a data gap for the overall Bethpage plant. The other two clusters were located downgradient of Site 3. Exact locations for the two well cluster at Site 3 were determined in the field based on soil-gas and temporary monitoring well testing with two wells per cluster and one sample per well. Two Grumman monitoring wells were used as upgradient wells. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6} and cyanide using CLP procedures.	Site 3 was used to store halogenated and nonhalogenated solvents, cyanide, and cadmium wastes. Although there were no reported spills in the area, there are potential unreported spills and leaks in this area. Site 3 was also used to store fixtures, tools, and metallic wastes. There are also reports of surface oil contamination. These contaminants may have migrated into the groundwater. One sample was analyzed for the general engineering/remediation parameters of TDS, alkalinity, hardness, BOD, TOC, and TSS.
None	Groundwater	Collect one groundwater sample from each of four operating production wells and the USGS well located at the NWIRP in Bethpage. Analysis: TCL VOA and SVOA, TCL metals, Cr^{+6}, and cyanide using CLP procedures.	These samples provided an indication of local groundwater quality at the NWIRP.

2.1.2 Data Quality Objectives

The overall objective of the RI was to characterize the nature and extent of potential environmental contamination and associated risks to human health and the environment at the NWIRP. The data collected was also used to evaluate potential remedial options. The specific objectives for the Bethpage plant were to identify the location and concentration of potential solvent and metal contamination of soil and groundwater at three sites identified in the Initial Assessment Study (RGH 1986) and to determine whether these sites are the source of a trichloroethene (TCE) contaminated groundwater plume in the Bethpage area. The NWIRP, Grumman, and RUCO are potential sources of this contamination.

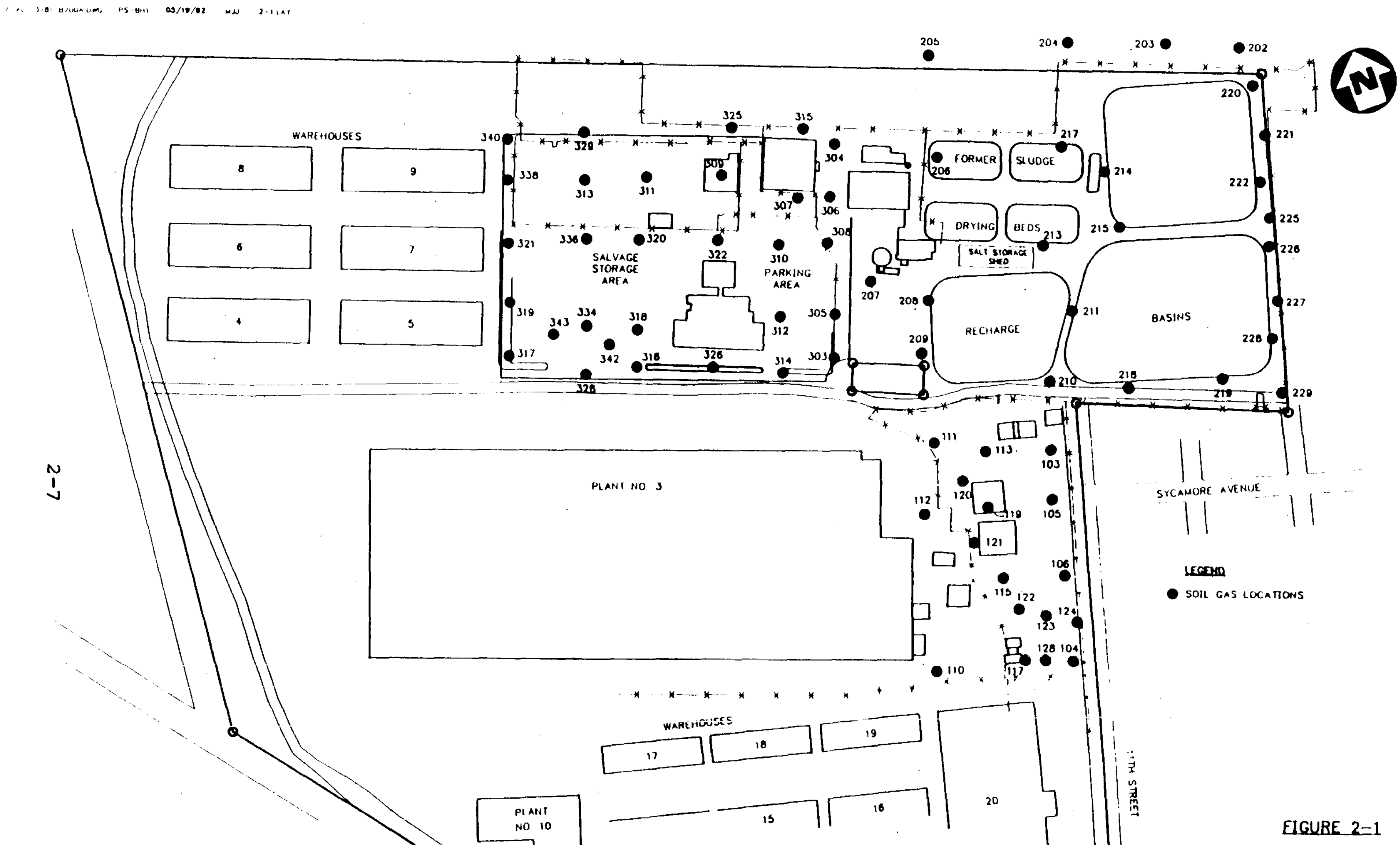
The uses of the data collected were to characterize the nature and extent of contamination, to assess the potential risks to human health and the environment, and, for engineering purposes, to develop remedial actions. The nature and extent of contamination included the areas and depths of contamination and contaminant concentrations. The risk assessment addressed the contaminants, receptors, and pathways for exposure. The engineering parameters were selected based on potential remedial actions including groundwater pump-and-treat options and soil treatment/offsite disposal options.

The NWIRP, Bethpage, is not currently on the CERCLA National Priorities List (NPL). However, it is possible that the site may be placed on the National Priorities List (NPL) list and that legal actions may be taken in the future. In accordance with Naval Energy and Environmental Support Activity (NEESA), for sites which are on or about to be placed on the NPL, Data Quality Objective (DQO) Level D quality control and CLP methods and protocol are to be used. These sites are typically near populated areas and are likely to undergo litigation.

DQO Level D QC includes review and approval of the laboratory QA plan, the site work plan, and the field QA plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports on QA. The laboratory that performs Level D QC must have passed the performance sample furnished through the Superfund Contract Laboratory Protocol (CLP) and must be able to generate the CLP deliverables.

2.2 Soil-Gas Survey

The soil-gas survey was performed to identify potential soil and groundwater contamination. The survey consisted of a uniform grid of soil-gas samples in each of the three sites (See Figure 2-1). A grid spacing of 150-foot centers was used. In addition, opportunity locations were selected in the field, based on results



0 200 400
SCALE IN FEET

FIGURE 2-1

SOIL-GAS LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

from grid pattern soil-gas locations, as well as areas of suspected contamination. At each location, soil-gas samples were obtained at two depths: 5 feet and 21 feet. The 5-foot depth represents potential contamination in the soil near the source of a spill. Elevated soil-gas measurements at this depth would likely be an indication of surface soil contamination. The 21-foot depth represents the practical depth of this technique, and the result would likely be influenced by both soil and groundwater contamination. The samples were analyzed in the field using a portable gas chromatograph equipped with an electron capture detector (GC/ECD).

The subcontractor used their own fixed-base laboratory for duplicate testing of samples in accordance with their QA Plan. Also, at one point, the capacity of the onsite laboratory was exceeded. Excess samples were shipped to the subcontractor's fixed-base laboratory to meet holding time requirements.

Based on this testing, temporary well point sample locations and soil sample locations and depths were selected. If minimal or no elevated soil-gas readings were found for any particular site, then temporary well sample points were located primarily along the upgradient and downgradient boundaries of that site. If elevated soil-gas readings were found, then 2 to 3 temporary well points were located along the hydraulic downgradient boundary of the site; 2 to 3 temporary well points were located along the hydraulic upgradient border of the site; and 3 to 4 temporary well points were located in the center of the contamination of the site.

Soil-gas samples were collected at a total of 73 locations over the NWIRP. Sixteen samples were taken at Site 1, twenty-five samples were taken at Site 2, and thirty-two samples were taken at Site 3.

Shallow (5 foot) and deep (21 foot) samples were collected at each location. To collect the samples, a van-mounted hydraulic probe was used to advance connected, 3-foot sections of 1-inch-diameter threaded steel casing to a depth of 5 feet. The entire sampling system was purged with ambient air drawn through an organic vapor filter cartridge. A Teflon line was inserted into the casing to the bottom of the hole, and the bottom-hole line perforations were isolated from the up-hole annulus by an inflatable packer. A sample of in-situ soil-gas was then withdrawn through the probe and used to purge atmospheric air from the sampling system. A second sample of soil-gas was withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure (15 pounds per square inch-gauge). The self-sealing vial was detached from the sampling system, packaged, labeled, and stored for laboratory analysis.

The hydraulic probe was then further advanced to a depth of 21 feet, and a deep sample was collected in the same manner as above.

Prior to the day's field activities all sampling equipment and probes were decontaminated by washing with soapy water and rinsing thoroughly. Internal surfaces were flushed dry using pre-purified nitrogen or filtered ambient air, and external surfaces were wiped clean using paper towels. After the collection of each sample, all equipment that contacted the soil (the stainless-steel pipes) was pressure washed prior to its reuse.

For quality assurance/quality control, field control samples were collected at the beginning of each day's field activities, after every twentieth soil-gas sample, and at the end of each day's field activities. These QA/QC samples were obtained by inserting the probe tip into a tube flushed by a 20 psi flow of pre-purified nitrogen and collecting a sample in the manner described above. Field Control Samples 101, 102, 109, 201, 224, 301, 302, and 332 were collected at the beginning of the day's field activities. Field Control Samples 106, 107, 114, 222, 323, 330, 331, and 344 were collected at the end of the day's field activities. These results are discussed in Section 4.0.

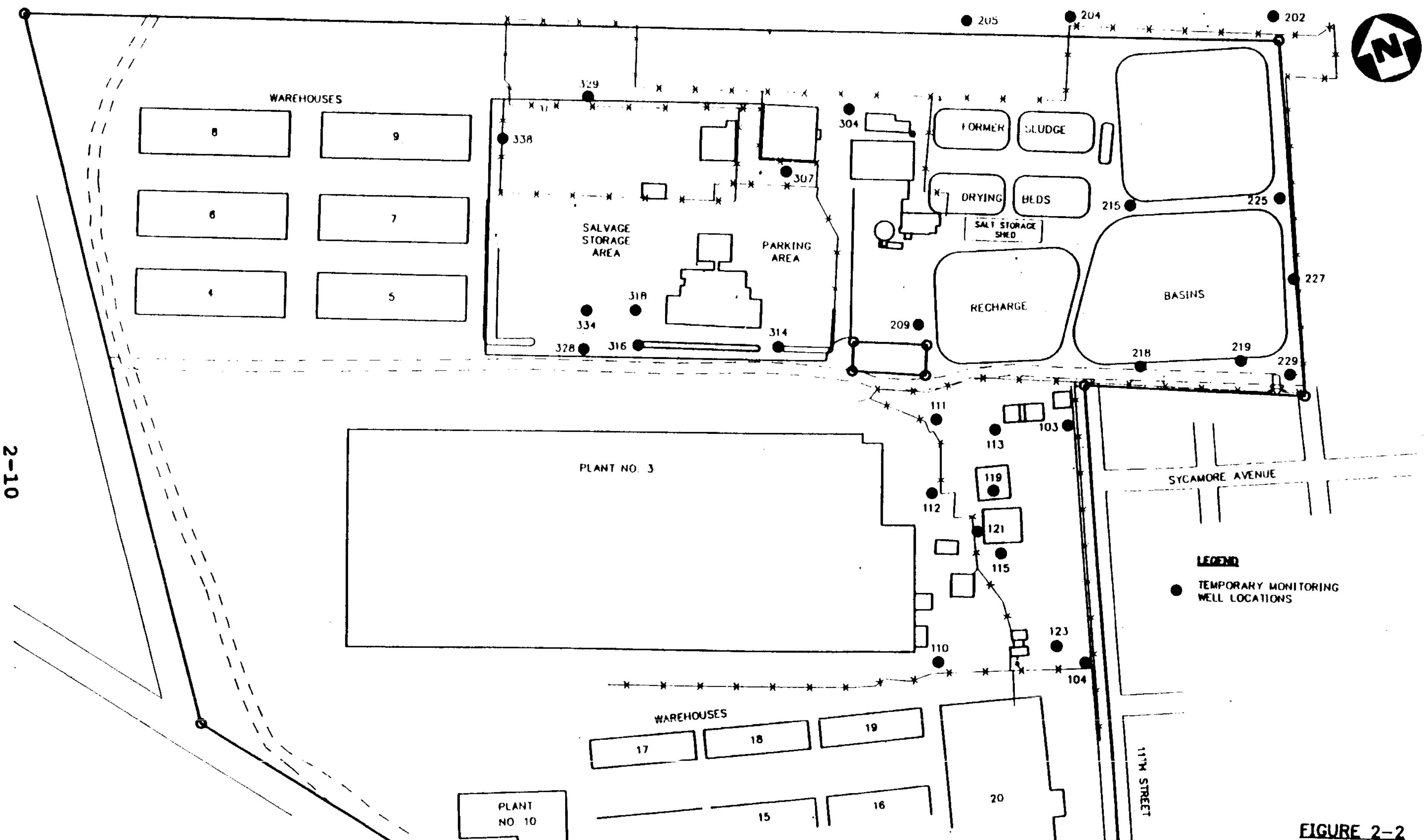
2.3 <u>Temporary Monitoring Well Survey</u>

A temporary monitoring well survey was conducted to aid in the placement of the permanent monitoring wells. The temporary well points were selected based on the results of the soil-gas survey. Twenty-nine temporary wells were installed, sampled, and analyzed for the following parameters: vinyl chloride; 1,1,-dichloroethene; trans-1,2-dichloroethene; 1,1-dichloroethane; cis-1,2-dichloroethene; 1,1,1-trichloroethane; 1,2-dichloroethane; trichloroethene; and tetrachloroethene. The location of the temporary wells is illustrated in Figure 2-2).

The temporary wells were drilled with a Mobil B-57 drilling rig. Hollow-stem augers were used to advance the borings through the overburden with a minimum borehole diameter of 6 inches. All 29 temporary wells were screened in the shallow part of the overburden aquifer. The well point consisted of a 2-inch well screen installed through the hollow-stem auger; the augers were pulled back to expose the screen. All temporary wells were constructed with 2-inch inside diameter, Schedule 40, flush-joint threaded, polyvinyl chloride (PVC) pipe and a 10-foot length of PVC screen with a slot size of 0.010 inches, capped at the bottom by a PVC end plug. The well point was purged a minimum of three volumes with a stainless- steel bailer and a sample was collected using the bailer.

Twenty-nine temporary wells were sampled and analyzed for the following volatile organics at the site: vinyl chloride; 1,1-dichloroethene (1,1-DCE); trans-1,2-dichloroethene (t-1,2-DCE); 1,1-dichloroethane (1,1-DCA); cis-1,2-dichloroethene (c-1,2-DCE); 1,1,1-trichloroethene (1,1,1-TCA); 1,2-dichloroethane (1,2-DCA); trichloroethene (TCE); and tetrachloroethene (PCE).

ACAD: 3281\B200A.DWG 02/27/92 MB 2-2LAY



0 200 400
SCALE IN FEET

TEMPORARY MONITORING WELL LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 2-2

HALLIBURTON NUS
Environmental Corporation

2.4 Soil Borings and Sampling

Forty-eight subsurface soil samples and four duplicate samples were collected at the 29 temporary monitoring well locations during temporary well drilling operations. The locations of the soil borings are presented in Figure 2-3.

The subsurface soil samples were collected at a depth of 3 to 5 feet and/or 19 to 21 feet. For each location, the decision to sample was dependent on the soil-gas measurement at that location and depth. In general, if volatile organics were detected at that point, then a soil sample was obtained for offsite, fixed-base, laboratory analysis. If volatile organics were not detected at that point, then a soil sample was not obtained. However, several soil samples were collected at points where soil-gas measurements indicated the absence of soil contamination. These samples were analyzed off site at a fixed-base laboratory to confirm the absence of soil contamination.

The samples were collected by driving a 2-inch-outside-diameter by 24-inch length split-barrel sampler with repeated blows using a 140-pound weight falling a distance of 30 inches. A portion of the soil recovered was placed in appropriate jars for shipping and analysis. Sample log sheets for all soil samples are included in Appendix B.

All the samples were analyzed for TCL volatile organics. The near-surface (3 to 5 feet deep) soil samples were also analyzed for semivolatile organics, TAL metals, and cyanide. Four samples identified as stained were also analyzed for PCBs and pesticides.

In addition to these chemical analyses, six select samples were evaluated for engineering parameters. Two samples were selected at each site plus one duplicate sample (for a total of seven), based on the field screening data. For each site, one sample represented a relatively low level of contamination, and the second sample represented an intermediate or high level of contamination. The engineering parameters consist of

- Total organic carbon (TOC) to evaluate the potential for groundwater contamination through an estimate of the contaminant soil/water partition coefficient.
- Bulk density, grain size, moisture content, and pH for general engineering considerations.

2.5 Surface Soil Sampling

Twenty-nine surface soil samples and four duplicate samples were collected from locations that consisted of points in a relatively uniform, 300-foot by 300-foot grid plus field opportunity sample locations. In addition, four samples identified as stained were analyzed for PCBs and pesticides.

ACAD 3281\B200A.DWG 02/27/92 MB 2-3LAY

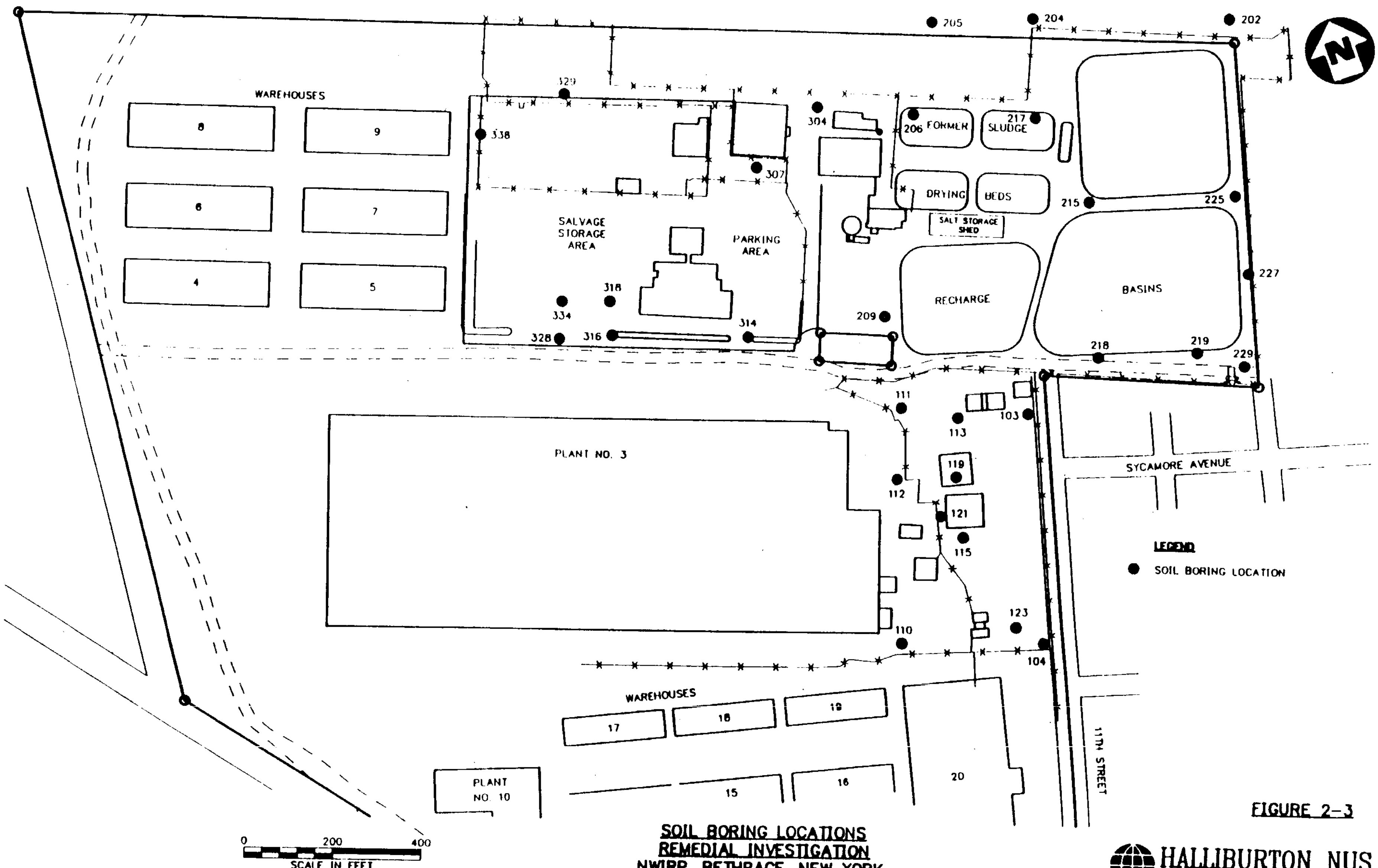


FIGURE 2-3

SOIL BORING LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

The surface soil sample locations are illustrated in Figure 2-4. There was a 2- point by 3-point grid at Site 1; a 3-point by 4-point grid at Site 2; and a 2-point by 3-point grid at Site 3. The opportunity samples were selected in the field during the sampling activities. Soils which appeared to be stained or visually discolored were selected. The samples were collected at a depth of 1 to 6 inches and were analyzed for TCL volatile and semivolatile organics, TAL metals, cyanide, and PCBs/pesticides. The samples were collected with a stainless-steel trowel and were placed in appropriate jars for shipping and analysis. The analytical results are discussed in Section 4.0. The chain-of-custody forms are provided in Appendix C.

2.6 Monitoring Well Installation

Monitoring wells were installed to evaluate the impact of the three sites on the local groundwater quality and to assess the potential vertical and lateral migration of any contaminants. The potential vertical migration of the contaminants was investigated through the construction of well clusters composed of shallow (49- to 59-foot deep), intermediate (110-to 158-foot deep), and deep (198- to 230-foot deep) monitoring wells. These yield groundwater quality analyses from various depths and define the magnitude and direction of local vertical hydraulic gradients. The potential lateral migration of contaminants was investigated through the placement of wells both upgradient and downgradient from the sites. The results of the soil-gas survey and of the temporary wells were used to determine the location of the monitoring wells.

A total of 17 monitoring wells (7 shallow, 7 intermediate, and 3 deep) were installed at the NWIRP. The location of these monitoring wells is provided in Figure 2-5. The shallow wells were drilled with a CME 75 drilling rig. Hollow-stem augers were used to advance the borings through the overburden with a minimum borehole diameter of 10 inches. The shallow wells were constructed to be screened across the water table. The depth of each well was selected so that 8 feet of the 10-foot screen was below the water table and 2 feet was above the water table.

To determine the screened interval for the intermediate and deep monitoring wells, a pilot hole was drilled at each well cluster with 6-inch outside diameter (OD) hollow-stem augers. Split-barrel samples were taken every 10 feet and put in glass jars. Headspace readings were taken with a portable photoionizer (Hnu) field instrument for each sample. A gamma ray logger was run in each pilot hole to identify the lithologies present at the non-sampled intervals. The screened interval for the intermediate and deep wells was determined based upon the results of the gamma ray log and the headspace readings. Complete boring logs for all wells are included in Appendix D.

ACAD: 3201\B200A.DWG 02/22/92 MB 2-4 LAY

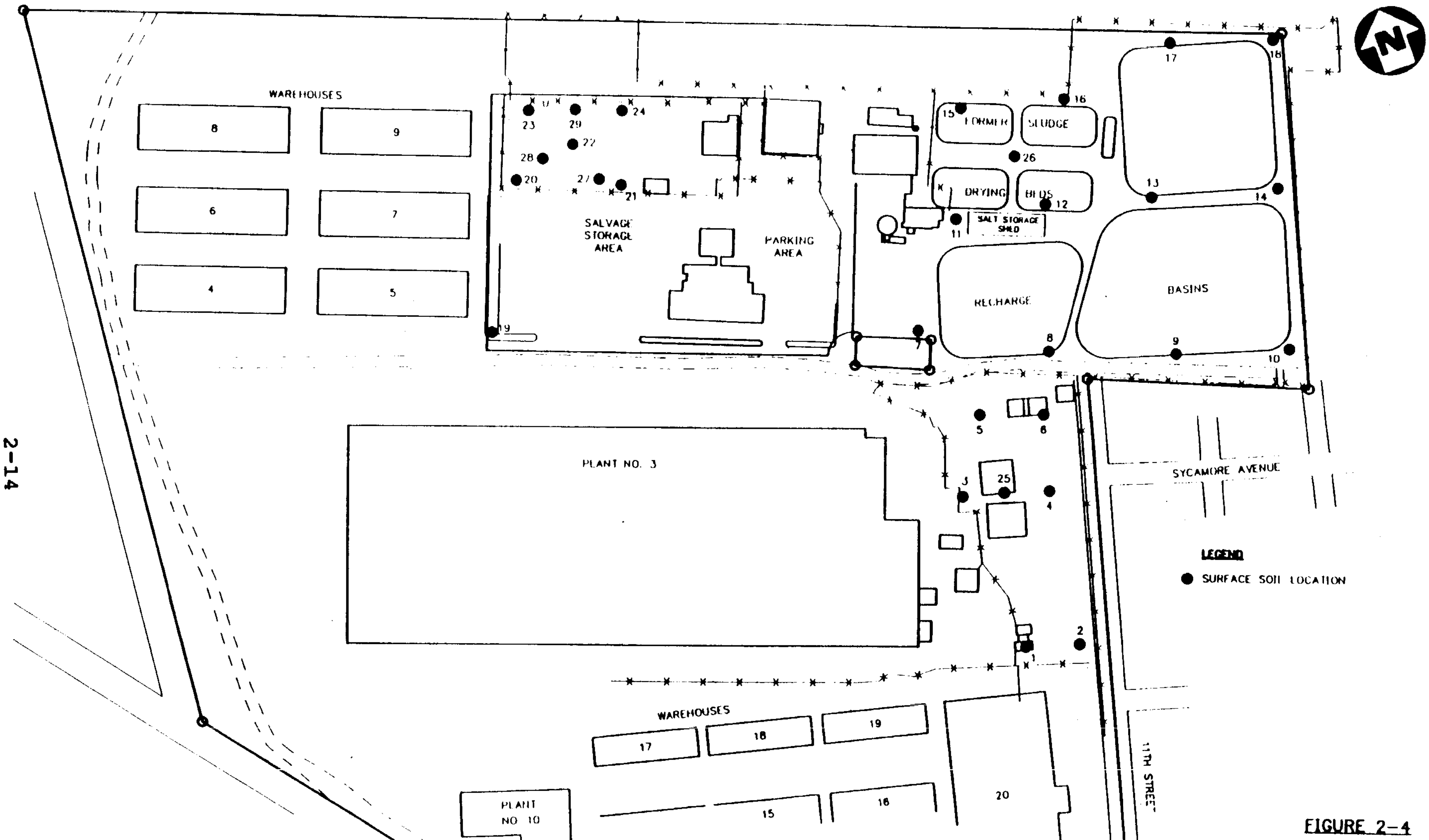
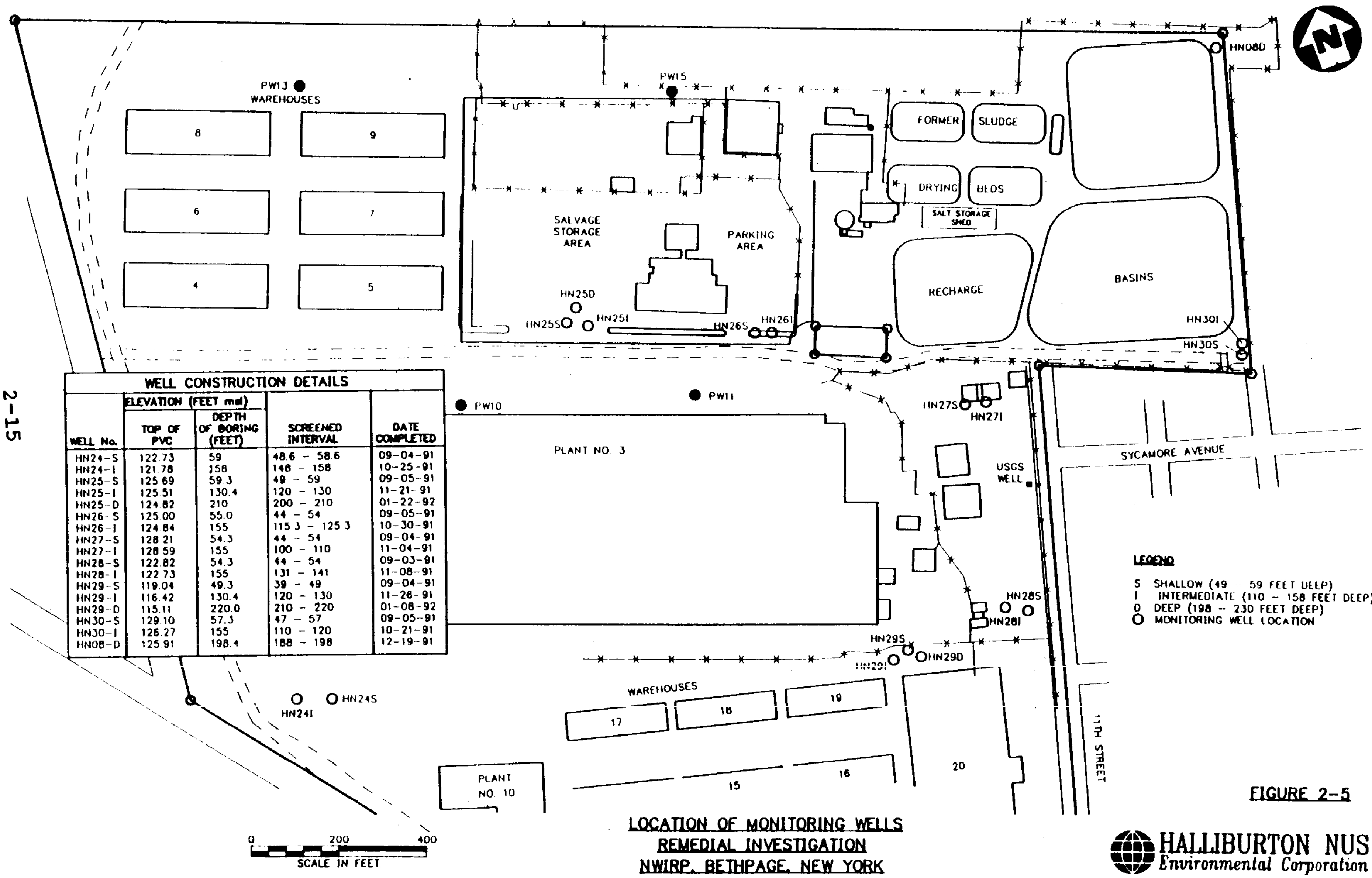


FIGURE 2-4

SURFACE SOIL SAMPLE LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation



WELL CONSTRUCTION DETAILS

WELL No.	ELEVATION (FEET msl) TOP OF PVC	DEPTH OF BORING (FEET)	SCREENED INTERVAL	DATE COMPLETED
HN24-S	122.73	59	48.6 – 58.6	09-04-91
HN24-I	121.78	158	148 – 158	10-25-91
HN25-S	125.69	59.3	49 – 59	09-05-91
HN25-I	125.51	130.4	120 – 130	11-21-91
HN25-D	124.82	210	200 – 210	01-22-92
HN26-S	125.00	55.0	44 – 54	09-05-91
HN26-I	124.84	155	115.3 – 125.3	10-30-91
HN27-S	128.21	54.3	44 – 54	09-04-91
HN27-I	128.59	155	100 – 110	11-04-91
HN28-S	122.82	54.3	44 – 54	09-03-91
HN28-I	122.73	155	131 – 141	11-08-91
HN29-S	119.04	49.3	39 – 49	09-04-91
HN29-I	116.42	130.4	120 – 130	11-26-91
HN29-D	115.11	220.0	210 – 220	01-08-92
HN30-S	129.10	57.3	47 – 57	09-05-91
HN30-I	126.27	155	110 – 120	10-21-91
HN08-D	125.91	198.4	188 – 198	12-19-91

FIGURE 2-5

LOCATION OF MONITORING WELLS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

The intermediate wells were drilled using a Failing F-10 rig. Hollow-stem augers were used to advance the borings through the overburden with a minimum borehole diameter of 10 inches.

The deep wells were also drilled using a Failing F-10 rig. The borings were drilled with the mud rotary technique to a depth of 20 feet above the top of the screened interval. At this depth, the mud was pumped out of the borehole, and a reverse-circulation, water rotary technique was used to advance the borehole through the interval to be screened to the total depth of the well. Samples were not collected during the drilling of the deep wells due to the drilling methods employed.

The monitoring wells were constructed with a 4-inch-diameter, Schedule 40 PVC well casing and 010-slot PVC well screen. The well screens were 10 feet in length, capped at the bottom with a PVC end plug. The annular space between the PVC well screen and the borehole was backfilled with a clean quartz sand pack composed of Morie No. 1 sand to a height of 3-5 feet above the top of the screen. For the shallow wells, a pellet bentonite seal with a minimum thickness of 2 feet was emplaced above the filter pack. For the intermediate and deep wells, a masonry sand seal of 2 to 4 feet thick was emplaced above the filter pack. A bentonite slurry of a minimum 3 foot thickness was emplaced by tremie above the masonry sand seal. The remainder of the annulus for all intermediate and deep wells and most shallow wells was backfilled with a bentonite/cement grout to a depth approximately 3 feet below ground elevation. Wells 24S, 27S, and 28S were backfilled with a thick bentonite grout.

All wells were developed a minimum of 48 hours after installation. As directed by the New York State Department of Environmental Conservation (NYSDEC), an attempt was made to develop each well to a water turbidity level of less than 50 NTU. This level was achieved at every well but one (HN-29S). In addition, the groundwater temperature, pH, and conductivity were monitored during development. The well development logs are included as Appendix E.

The shallow wells were developed with a submersible pump. These wells, with one exception, developed quickly and to a turbidity of less than 50 NTU after a maximum of approximately 500 gallons had been pumped. Well HN-29S was the exception. Despite repeated effort and the pumpage of more than 1,000 gallons, the turbidity readings of this well remained above the upper limit of the indicating range of the instrument, or above 200 NTU. The pH and temperature readings, however, indicated that stable conditions had been reached. After consultation with the onsite NYSDEC representative, it was decided that further development was not needed.

The intermediate and deep wells were developed through air lifting. These wells, with one exception, developed quickly and to a turbidity of less than 50 NTU. Well HN-28I was the exception.

This well required surge-blocking before it developed to a turbidity of less than 50 NTU. The amount of water developed from the wells was also controlled by the amount of water added to the borehole to control running sands during hollow-stem auguring and/or the amount of water estimated to have been lost to the formation during the reverse-circulation drilling. In all cases, the amount of water removed during development greatly exceeded the amount introduced during well installation. In general, between 3,500 and 7,000 gallons of water were pumped from each well during development.

2.7 Groundwater Sampling

Sampling and analysis of groundwater was conducted to determine the current level and extent of contamination and to provide data for use in the risk assessment and the evaluation of remedial action alternatives for the Feasibility Study. The groundwater sampling was conducted from December 3 through December 11, 1991, and included 19 wells: 14 shallow and intermediate wells, 1 USGS well, and 4 process wells. The groundwater sampling for the three deep wells was conducted on February 11 and 12, 1992. Monitoring well locations are shown in Figure 2-5.

The groundwater sampling and analysis program and sampling procedures are described in the Final RI Work Plan and Quality Assurance Plan.

Field measurements collected during sampling were pH, temperature, specific conductivity, and turbidity. These results are provided in Appendix E. Groundwater samples were submitted to a Naval Energy and Environmental Support Activity (NEESA) approved laboratory using CLP methods. All groundwater samples were analyzed for Target Compound List (TCL) volatile organics, TCL semivolatile organics, Target Analyte List (TAL) metals (total and dissolved), cyanide, and hexavalent chromium. Sample log sheets for all wells are included in Appendix B.

In addition to the chemical analysis used for the nature and extent of contamination and risk assessment, select samples were also evaluated for engineering parameters. Three samples were selected from all of the monitoring wells based on the field screening data; one sample representing a relatively low level of contamination (HN25-I), one sample representing an intermediate level of contamination (HN27-I), and one sample representing a high level of contamination (HN29-S). These engineering parameters consisted of the following -- pH, total dissolved solids (TDS), alkalinity, and hardness to evaluate the scaling potential of the groundwater; biochemical oxygen demand-5 day (BOD), total organic carbon (TOC), and total suspended solids (TSS) -- to evaluate other contamination in the groundwater and potential treatment requirements.

Quality control samples, including field duplicates, trip blanks, and rinsate blanks, were collected and analyzed for each sampling round as specified in Table 2-7.

TABLE 2-7

NEESA LEVEL D REQUIREMENTS
NWIRP, BETHPAGE, NY

QA/QC TYPE	NEESA REQUIREMENT
Field Duplicate	One duplicate in 10 samples per sample matrix.
Rinsate Blank	One sample of the final rinse during decontamination of sampling equipment per day. Initially, samples from every other day are analyzed. If analytes pertinent to the project are found in the rinsate, the remaining samples are analyzed.
Field Blank	One sample of each source water used for decontamination of sampling equipment for each sampling event.
Trip Blank	One sample of analyte-free water per day, for each shipment of samples, for volatile organic analysis.
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One sample in 20 samples per sample matrix.

The analytical results for groundwater sampling are discussed in Section 4.0.

2.8 Surface Water and Sediment Sampling

Two samples of surface water were collected at the site. One surface water sample was taken from the influent cooling water recharge basin to evaluate potential contamination in process-generated wastewaters, and the other sample was collected during a precipitation event from the influent storm water discharge recharge basin to evaluate the potential transport of contamination into the basins via storm water discharge.

Surface water sampling was conducted on December 4, 1991 following a day (December 3) of steady rain. There were intermittent snow showers at the time the sample was collected. The samples were submitted to a NEESA-approved laboratory using CLP methods. All surface water samples were analyzed for TCL volatile organics, TCL semivolatile organics, TAL metals (total and dissolved), cyanide, and hexavalent chromium.

Four sediment samples were collected at the site. Two sediment samples were taken in each active basin. A third basin at the site was not sampled because it is not currently in use and the sediment has been stripped away. Sediment sampling was conducted on August 27, 1991, and on December 11, 1991. All sediment samples were analyzed for TCL volatile and semivolatile organics, TAL metals, and cyanide.

Sampling point locations for surface water and sediment samples are illustrated in Figure 2-6. The analytical results for surface water and sediment sampling are discussed in Section 4.0.

Quality control samples including field duplicates, trip blanks, and rinsate blanks were collected and analyzed as specified in the Final Quality Assurance Plan and the Final Work Plan.

2.9 Water-Level Measurements

Two complete rounds of groundwater-level measurements were taken on December 18, 1991, and January 24, 1992, from 30 wells throughout the study area to better define groundwater flow paths and horizontal and vertical gradients. It should be noted that groundwater level measurements taken on December 18, 1991, exclude wells HN-25D, HN-29D, and HN-08D, which had not been drilled when the measurements were taken.

All groundwater-level readings were conducted using calibrated electrical water-level indicators (M-scopes), or a weighted tape measure coated with chalk if moisture on the side of the well casing was affecting the M-scope. All measurements were measured from a marked point on the top of the PVC well riser pipe. On four wells (GM-7S,7I,7D,13D), measurements were taken from the top of a surface casing, which was on top of the well. Geraghty and Miller

ACAD 3281\8200A DWG 02/27/92 MB 2 6 LAY

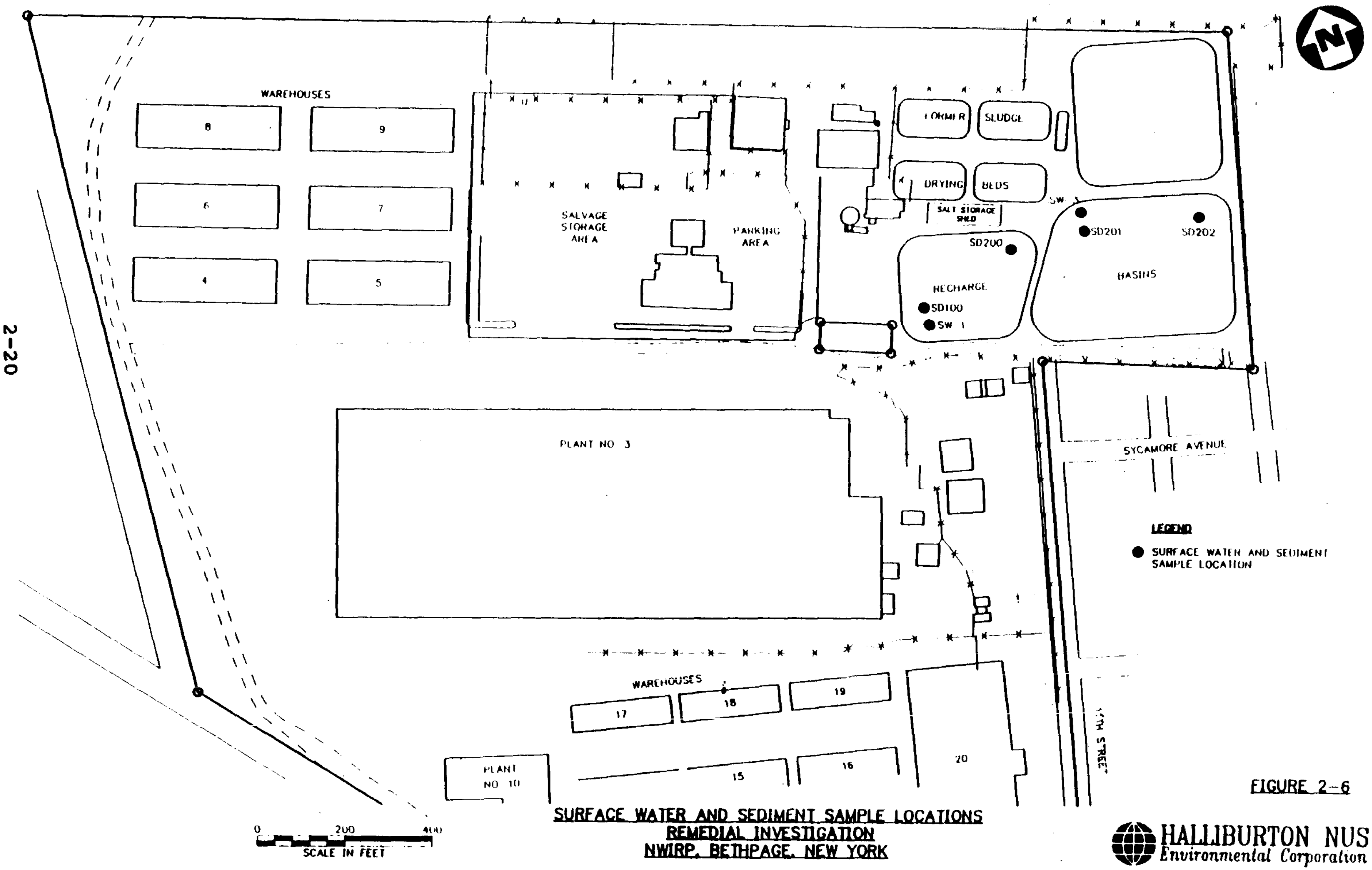


FIGURE 2-6

SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS Environmental Corporation

has provided the necessary information to convert the readings to the top of polyvinyl chloride (PVC). All measurements were recorded to the nearest 0.01 foot. Measurements for each water level round were conducted within a 24-hour period of consistent weather conditions to minimize precipitation/atmospheric effects on groundwater levels.

Groundwater contour maps developed using these measurements are presented in Section 3.0.

2.10 Horizontal and Vertical Elevation Survey

Between December 19, 1991, and January 29, 1992, horizontal locations and vertical elevations were surveyed at 17 newly installed monitoring wells a previously installed USGS well, 29 surface soil locations, and 73 soil gas locations.

Surveying for each well included the elevation of the ground surface adjacent to the well, and the top of the PVC riser. Surveying for all other locations was conducted at the spot of the sample. Surveying notes are provided in Appendix F.

3.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

3.1 Surface Features

The NWIRP Bethpage is located on Long Island, New York. It is located on a relatively flat, featureless, glacial outwash plain. The site and nearby vicinity are highly urbanized. Because of this, most of the natural physical features have been reshaped or destroyed. The topography of the activity is relatively flat with a gentle slope toward the south. Elevations range from greater than 140 feet (above mean sea level, MSL) in the north to less than 110 feet (above MSL) at the southwest corner (RGH, 1986).

The NWIRP is about 108 acres in size. The dominant features at the activity are Plant No. 3 (the manufacturing plant) and three groundwater recharge basins located at Site 2. The recharge basins are each approximately 1.5 to 2.5 acres in area and about 30 feet deep. Other notable features at the site are a wastewater treatment plant at Site 2, an office building at Site 3, and a drum marshaling area at Site 3.

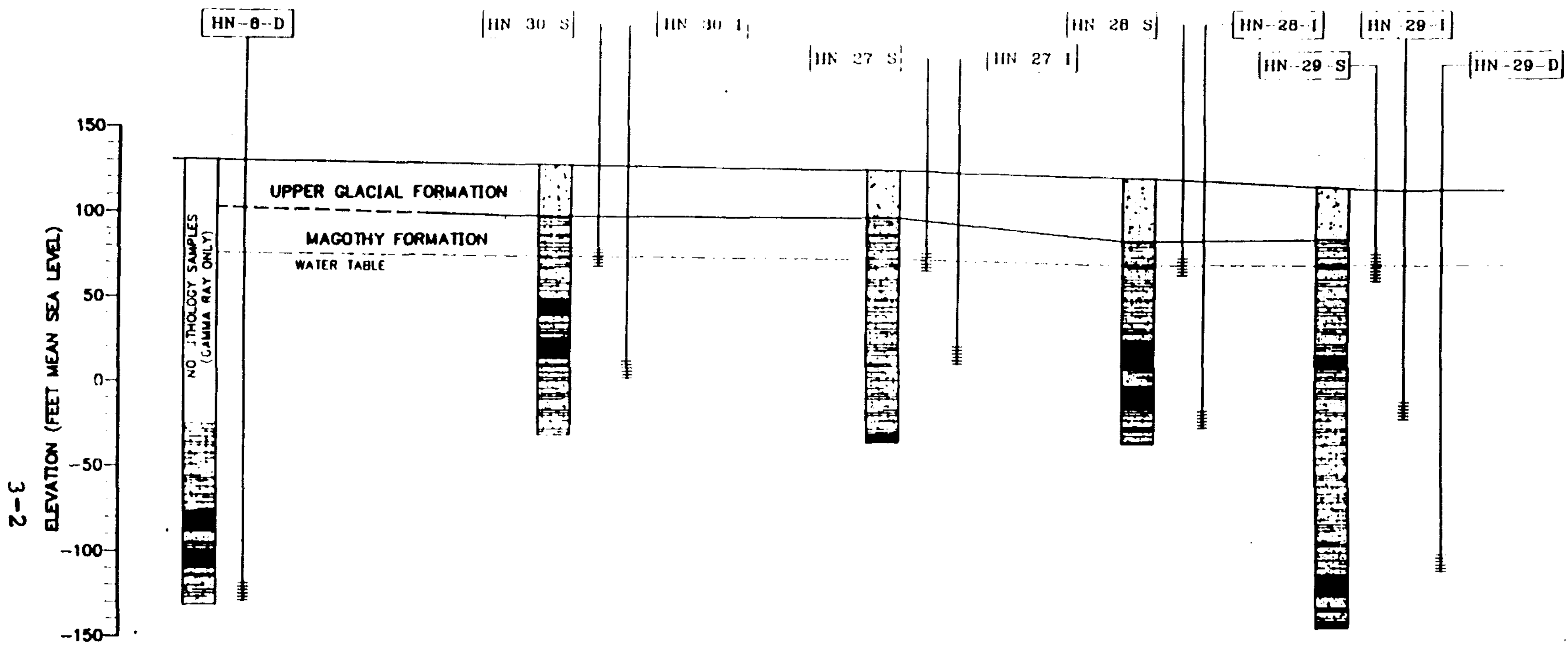
3.2 Geology

3.2.1 Summary

The NWIRP is underlain by approximately 1,100 feet of unconsolidated sediments that unconformably overlie crystalline bedrock. The unconsolidated sediments consist of four distinct geologic units that, in descending order, are the Upper Glacial Formation, the Magothy Formation, the Raritan Clay Member of the Raritan Formation, and the Lloyd Sand Member of the Raritan Formation. The crystalline bedrock consists primarily of metamorphic and igneous rocks including schist, gneiss, and granite. The regional dip of the bedrock is to the south and southeast. All of the geologic units dip in these directions, although to varying degrees (Isbister, 1966).

The Upper Glacial and the Magothy Formations were penetrated and sampled; the Raritan Formation lies below the depth of this investigation. The Upper Glacial Formation, which is about 30 to 45 feet thick, consists chiefly of coarse sands and gravels. The upper Magothy Formation consists chiefly of coarse sands to a depth of about 100 feet, below which finer sands, silts, and clays predominate. The clay is fairly common but laterally discontinuous; no individual clay horizon of regional extent underlies the NWIRP. Two cross-sections (Figures 3-1, North-South and 3-2, East-West) illustrate the geological conditions beneath the NWIRP. Cross-section locations are illustrated in Figure 3-3.

ACFILE: 3281\3-1.DWG (07/27/92) RAC



LEGEND

UPPER GLACIAL FORMATION: dominantly coarse brown sands & gravels

MAGOTHY FORMATION: interbedded sands, silts, and clayey and silty sands. Generally coarser grained at top, becoming increasingly finer-grained with depth.

MAGOTHY FORMATION: clays. Lithologies range from black, very hard and brittle clays to gray, soft and plastic clays.

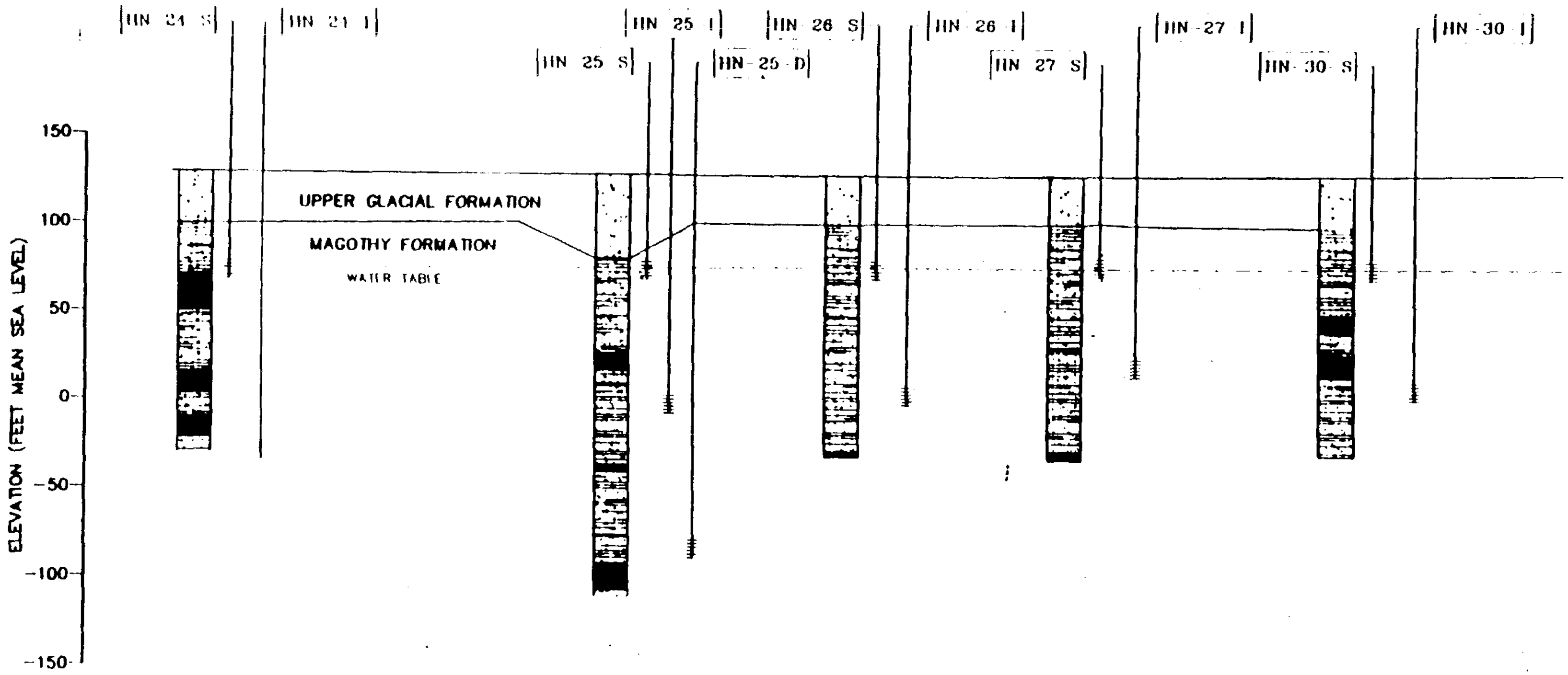
NOTES

1. WELLS ARE NOT TO HORIZONTAL SCALE.
2. SEE FIGURE 3-3 FOR WELL LOCATIONS.

FIGURE 3-1

NORTH-SOUTH CROSS-SECTION THROUGH THE NWIRP
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation



LEGEND

UPPER GLACIAL FORMATION: dominantly coarse brown sands & gravels

MAGOTHY FORMATION interbedded sands, silts, and clayey and silty sands. Generally coarser grained at top, becoming increasingly finer grained with depth.

MAGOTHY FORMATION clays. Lithologies range from black, very hard and brittle clays to gray, soft and plastic clays

NOTES

1. WELLS ARE NOT TO HORIZONTAL SCALE.
2. SEE FIGURE 3-3 FOR WELL LOCATIONS.

EAST-WEST CROSS-SECTION THROUGH THE NWIRP
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 3-2

HALLIBURTON NUS Environmental Corporation

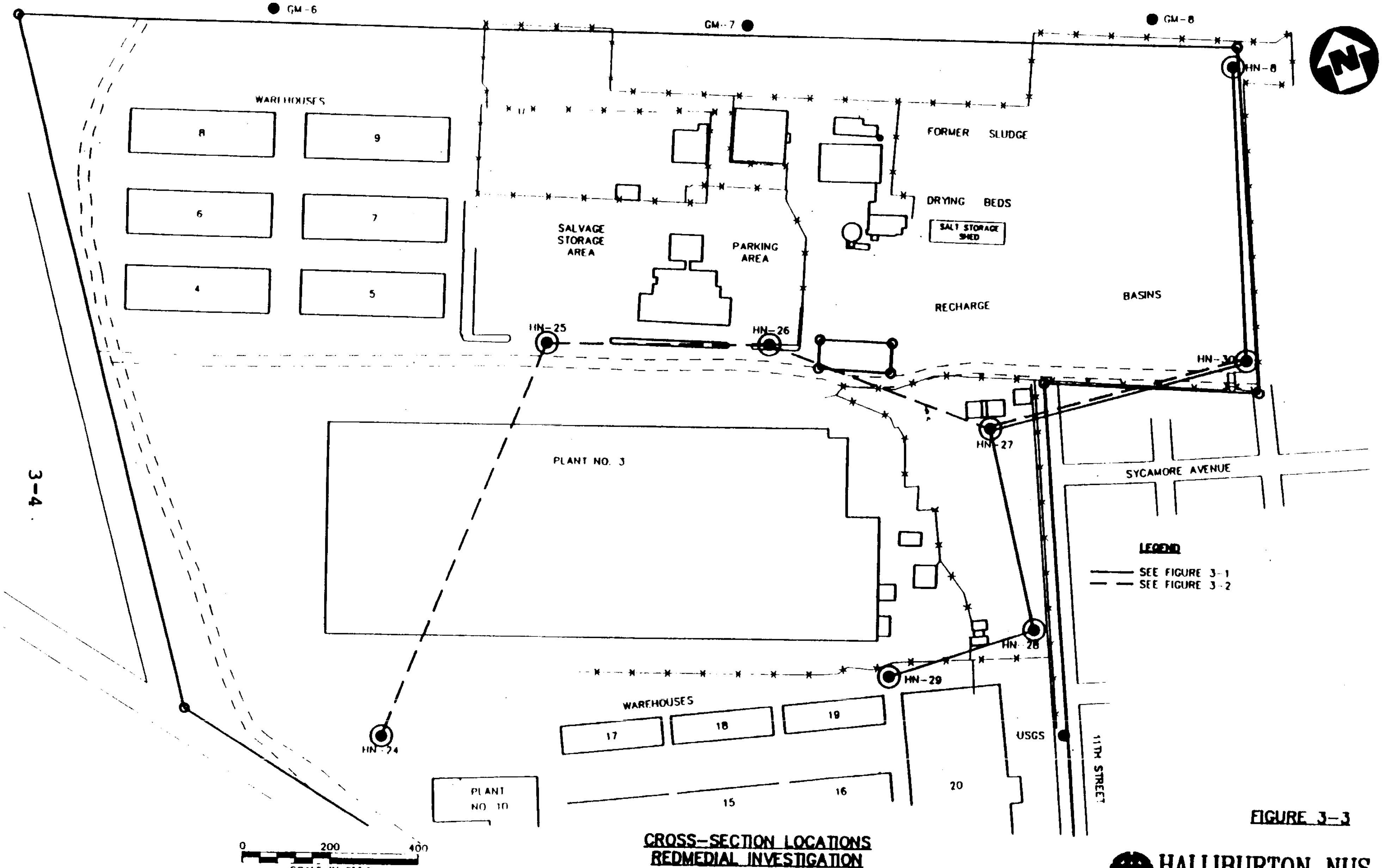


FIGURE 3-3

CROSS-SECTION LOCATIONS
REDMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

3.2.2 Stratigraphy

3.2.2.1 Upper Glacial Formation

The NWIRP lies on a featureless glacial outwash plain that slopes gently to the south. The Long Island region was subjected to several episodes of glaciation during the Pleistocene Period that resulted in the deposition of two moraines. The younger, Harbor Hill end moraine trends roughly east-west along Long Island's northern shore, approximately 10 miles north of the activity. The older, Ronkonkoma terminal moraine lies several miles north of the site, trends east-west, and basically bisects Long Island. As the glaciers retreated, large volumes of sediment were transported downgradient by meltwater-supplied streams and were deposited either in intermorainal areas or, south of the Ronkonkoma moraine, on large, topographically subdued glacial outwash plains. The NWIRP lies upon such an outwash plain (Isbister, 1966; McClymonds and Franke, 1972).

The Upper Glacial Formation (commonly referred to as glacial deposits) forms the surface deposits across the entire NWIRP. The formation penetrated beneath the NWIRP consists of coarse brown sands and gravels. Gravel recovered during onsite drilling operations in the split-spoons was as large as 2.5 inches in size. Larger pieces were brought to the surface by the hollow-stem augers. The gravels occurred either in beds dominated by a coarse sand matrix, in thin, discrete gravel beds, or in thicker gravel lenses. The base of the glacial deposits (top of the Magothy Formation) was defined in the field as the horizon where gravel becomes very rare to absent, and variegated finer sands, silts, and clays predominate. This agrees with the formation's description as reported in the literature (Isbister, 1966). It should be noted, however, that the generally coarse nature of both formations near their contact often makes their differentiation rather subjective.

The extensive construction activity that has taken place at each site has undoubtedly destroyed the natural stratigraphic profile. The surface sediments described as and assigned to the Upper Glacial Formation possibly consist of disturbed material in some instances. An abandoned septic drainage field, for example, underlies a large part of Site 1. Some areas of Site 2 have been excavated and/or graded during the construction of the recharge basins or the construction and subsequent abandonment of the sludge drying beds. The depth of disturbance at these areas is not known. Differentiation between disturbed and natural material was made more difficult by the apparent backfilling of the disturbed areas with the same glacial deposits. An attempt was made in all cases to identify non-native material.

The combined thickness of the glacial deposits beneath the entire Grumman complex is reported in the literature to range between 40 to 130 feet (G&M, 1990). The results of the current soil boring and well installation program indicate that beneath the NWIRP the glacial deposits are generally thinner, and range in thickness from approximately 30 to 45 feet (see soil boring and monitoring well drilling logs, Appendices C and D).

The base of the glacial deposits (the contact with the Magothy Formation) is an irregular and undulating, unconformable surface formed by the large-scale erosion and/or deposition of sediments by glacial outwash streams (Isbister, 1966). This relationship is apparent at location HN-25. Here, abundant gravels were encountered to depths of 45 feet, whereas at a location only several hundred feet away (HN-26), and along strike, the base of the gravel was at a depth of 26 feet.

Another characteristic of glacial outwash deposits is their lateral heterogeneity. Again, this is clearly seen at location HN-25. As stated, a thick gravel lense was encountered to a depth of 45 feet. This lense was such a hindrance during drilling operations that several boreholes had to be abandoned. A successful borehole was completed approximately 30 feet east of the original borehole, where little gravel was encountered. The origin of these stratigraphic units is unknown, but it is hypothesized that the gravel lense is a Pleistocene channel point-bar or braided stream deposit.

3.2.2.2 Magothy Formation

The Magothy Formation regionally consists of "interbedded gray, buff, and white fine sand and clayey sand and black, gray, white, buff, and some red clay." (Isbister, 1966) The drilling program at NWIRP confirms that the local lithology is similar to the regional description, with the addition of numerous silty intervals.

A general lithologic trend observed in the Magothy Formation during the drilling program is a decrease in average grain size with increasing depth. The upper Magothy is chiefly composed of thick beds of fine to coarse sands to a depth of about 100 feet. Below this depth, the relative abundance of finer-grained sediments increases sharply, and the formation is composed of fine to medium sand, silt, and clay. The coarser grained sands are relatively rare and occur in thinner, more discrete beds. Rather than exhibiting a continuous or "blanket sand" type geometry, these sands are found in lenses distributed throughout the finer grained matrix. Gravels are relatively rare to absent throughout the entire Magothy section.

Although fine-grained sediments are common within the Magothy Formation, no clays of "activity-wide" extent were penetrated to the depths of this investigation, or 250 feet (see cross-sections, Figures 3-1 and 3-2). For example, in the southern part of Site 1 (locations HN28 and HN29), an extremely dense and hard clay occurs at a depth of approximately 100 feet. This clay is absent in the northern part of Site 1 (location HN27), which is only several hundred feet to the north. A very sticky clay occurs at a depth of about 120 feet in HN28, but it is absent at HN29, which is along strike and only a short distance away.

As will be discussed in Section 3.3, the lack of any clay layers with regional extent has significant hydrological significance because it interconnects the glacial deposits and all horizons of the Magothy Formation, at least to the depth limits of this investigation.

The Magothy Formation has a reported thickness beneath the NWIRP of approximately 600 feet. The basal Magothy consists of a highly permeable and productive gravel. This horizon was not penetrated or sampled in this investigation (Isbister, 1966; G&M, 1990).

3.2.2.3 Raritan Formation

The Raritan Formation underlies the Magothy Formation at subsurface depths of about 700 - 1,100 feet beneath the NWIRP. The formation lies completely below the depths of investigation for this study. Regionally, the Raritan Formation is composed of the Raritan Clay (about 100 to 150 feet thick) and the underlying Lloyd Sand Member of the Raritan Formation (about 300 feet thick) (Isbister, 1966).

3.3 Hydrogeology

3.3.1 Summary

The Upper Glacial Formation, the Magothy Formation, and the Lloyd Sand Member (Raritan Formation) are regional aquifers. The principal aquifers of concern in this investigation are the Upper Glacial and Magothy aquifers because of their shallow depths. The Magothy aquifer is the major source of public water in Nassau County. The Lloyd Sand is not widely exploited because of its depth. In addition, the Lloyd Sand is isolated from the shallower aquifers by the Raritan Clay confining unit (RGH, 1986; G&M, 1990).

The water table beneath the NWIRP occurred completely within the Magothy Formation in December 1991. The magnitude of the seasonal water table fluctuation beneath the site is unknown, but it is unlikely that the water table rises to the Upper Glacial Formation.

The geologic and hydrologic information obtained from this study indicate that the Upper Glacial and upper Magothy aquifers beneath the NWIRP are interconnected and may be considered a common aquifer. This confirms the fact that the site-specific geology is similar to the regional geology, as described in published reports. Groundwater in this aquifer occurs under water-table or unconfined conditions. The number and thickness of clay lenses increase with depth within the Magothy, but the horizontally discontinuous nature of these units prevents any one of them from functioning as an aquitard or semiconfining unit.

The groundwater beneath the NWIRP predominantly flows to the southwest and, to a lesser extent, to the south. The flow is greatly influenced by the groundwater mounding that occurs at the recharge basins and the groundwater withdrawal at the numerous facility wells. The wells have the potential to significantly change the local flow pattern. These wells operate on an irregular basis and in various combinations, which makes their influence on the local flow regime at any particular time difficult to predict.

The horizontal hydraulic gradient varies throughout the NWIRP due to the recharge basins and facility wells. The average hydraulic gradient calculated across the activity is about 5.3 feet/mile, which is significantly lower that the published regional gradient of 10 feet/mile. The average linear velocity of the groundwater at the water table is estimated to range from 0.2 ft/day to 0.9 ft/day, which is significantly less than the previously estimated 50 to 70 ft/day (see Appendix G for calculations).

The NWIRP occupies an area of recharge. Vertical hydraulic gradients are in a downward direction, but are very low. This agrees with previously published regional data.

3.3.2 Aquifer Characteristics

Although considered a common aquifer at NWIRP, the hydrologic characteristics of the Upper Glacial and Magothy aquifers are discussed individually in this section because hydrologic data for these aquifers are reported separately in the literature.

The water table beneath the NWIRP occurred completely within the Magothy Formation in December 1991 (Figures 3-1 and 3-2). The magnitude of the seasonal water table fluctuation is unknown, but it is unlikely that the water table rises to the Upper Glacial Formation. Regionally, the seasonal water table variation is reported to be approximately 4 feet (Isbister, 1966).

Although not the primary service of potable water for the area, the Upper Glacial aquifer is an important source of potable water in Nassau County; well yields as high as 1,100 gallons per minute (gpm) have been reported. The glacial deposits are characterized by a high primary porosity and permeability; the porosity is reported to exceed 30 percent. The estimated average values of hydraulic conductivity and transmissivity for the outwash deposits in the Bethpage area are 2,000 gallons per day per square foot (gpd/ft2) and 100,000 gallons per day per foot (gpd/ft), respectively. Although the water table beneath the NWIRP lies below these deposits, the high permeability of the glacial deposits allows for the rapid recharge of precipitation to the underlying Magothy (Isbister, 1966; McClymonds and Franke, 1972).

The Magothy aquifer is the major source of public water in Nassau County. The most productive water-bearing zones are the discontinuous lenses of sand and gravel that occur within the siltier matrix. The major water-bearing zone is the basal gravel. The NWIRP facility wells produce from the Magothy (see Table 3-1 and Figure 3-4). These wells, which are between 357 and 560 feet deep, each have a capacity of 1,200 gpm. According to Grumman personnel, the wells often are pumped near capacity (G&M,1990).

The average hydraulic conductivity of the Magothy aquifer decreases in a southeastward direction as it thickens and the coarser grained lenses become thinner and less persistent. The average transmissivity, however, tends to increase in this same direction due to the abrupt thickening of the aquifer. The estimated average values of hydraulic conductivity and transmissivity for the Magothy in the Bethpage area are 420 gpd/ft2 and 250,000 gpd/ft, respectively (G&M, 1990; Isbister, 1966; McClymonds and Franke, 1972).

The Upper Glacial and the Magothy aquifers are commonly regarded as a common aquifer. One reported pump test in Hicksville, New York, a short distance from the study area, showed hydraulic interconnection between the glacial outwash deposits and the underlying deposits of the upper Magothy Formation (Isbister, 1966).

The site-specific lithologic and hydrologic information obtained from the current drilling program indicates that the Upper Glacial and Magothy aquifers beneath the NWIRP are similarly interconnected and function as a common aquifer. The gravels and coarse sands of the Upper Glacial aquifer are in direct contact with the permeable sands of the Magothy aquifer. There was no evidence of any clay layer or finer grained interval that could have served as even a local aquitard or semi-confining layer (see soil boring and monitoring well drilling logs, Appendices C and D, and geologic cross-sections, Figures 3-1 and 3-2).

The static water levels of the NWIRP monitoring wells, as measured on December 18, 1991, are presented in Table 3-2. Note that for any particular cluster, the static water elevations for the shallow and intermediate wells vary from 0.01 feet to about 5 feet, indicating highly variable vertical gradients. According to one published report, the potentiometric surface of confined aquifers in central Long Island is typically 30 to 40 feet below the water table (McClymonds and Franke, 1972). The water level elevations for the NWIRP wells, therefore, appear to confirm that both the Upper Glacial and upper Magothy aquifers are unconfined and function as a common aquifer.

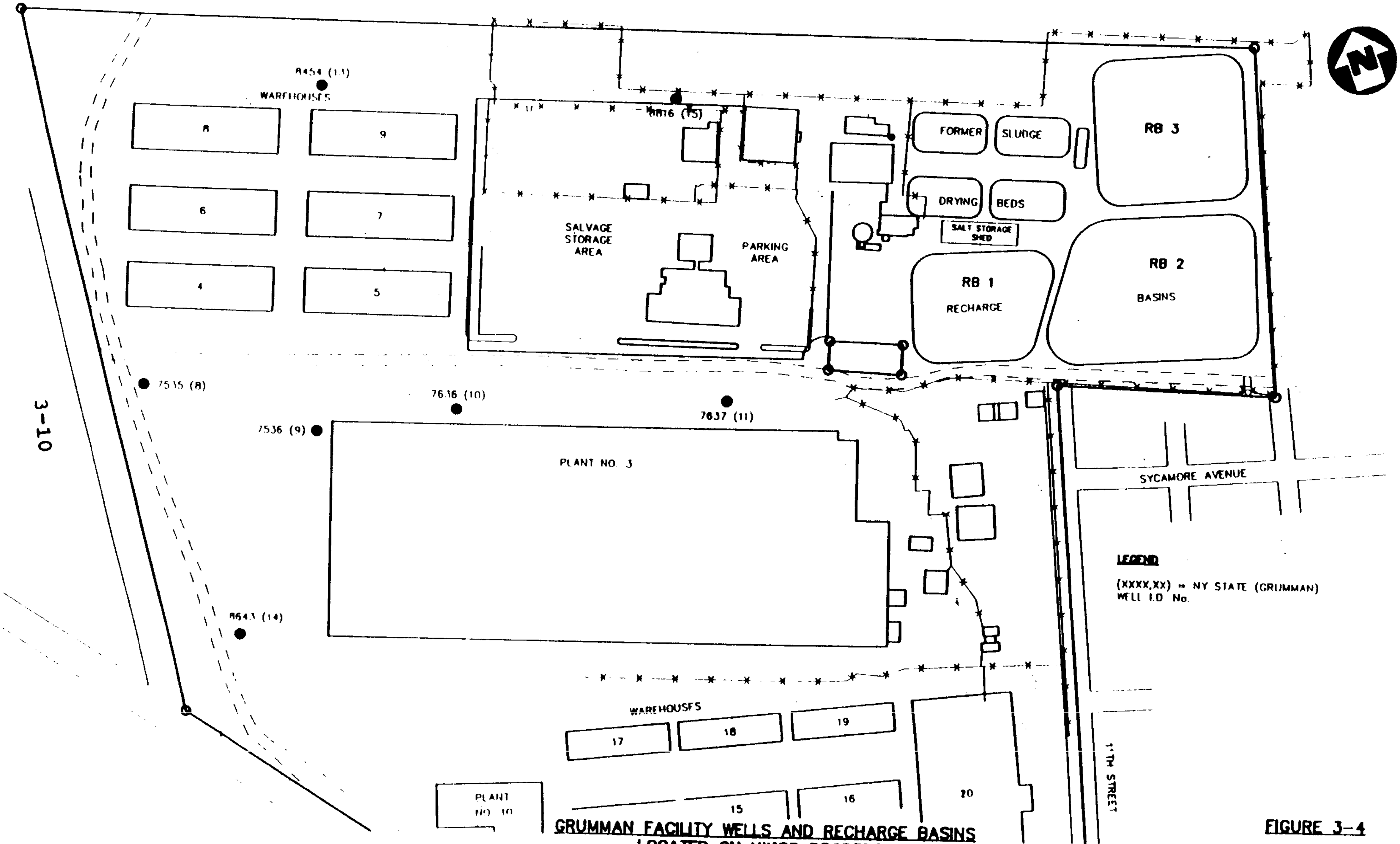


FIGURE 3-4

GRUMMAN FACILITY WELLS AND RECHARGE BASINS
LOCATED ON NWIRP PROPERTY
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

TABLE 3-1

WELLS LOCATED ON NWIRP PROPERTY
(SEE FIGURE 3-4 FOR WELL LOCATIONS)
NWIRP, BETHPAGE, NY

NY STATE ID	GRUMMAN ID	DEPTH (FT)	SCREENED INTERVAL (FT)	CAPACITY (GPM)	AQUIFER
7536	9	436	375-436	1200	Magothy
7535	8	357	280-290 305-357	1200	Magothy
7636	10	373	312-373	1200	Magothy
7637	11	490	429-489	1200	Magothy
8454	13	560	499-560	1200	Magothy
8643	14	467	416-467	1200	Magothy
8816	15	500	450-500	1200	Magothy

TABLE 3-2
GROUNDWATER ELEVATIONS
NWIRP, BETHPAGE, NY

WELL #	TOP OF PVC (FEET MSL)	DECEMBER 18, 1991		January 24, 1992	
		DEPTH TO WATER (FEET)	WATER ELEVATION (FEET MSL)	DEPTH TO WATER (FEET)	WATER ELEVATION (FEET MSL)
HN24-S	122.73	49.74	72.99	50.38	72.35
HN24-I	121.78	49.16	72.62	50.05	71.73
HN25-S	125.69	51.85	73.84	52.61	73.08
HN25-I	125.51	51.68	73.83	52.49	73.02
HN25-D	124.82	NA	NA	53.81	71.01
HN26-S	125.00	49.62	75.38	50.49	74.51
HN26-I	124.84	49.98	74.86	50.60	74.24
HN27-S	128.21	52.83	75.38	53.57	74.64
HN27-I	128.59	53.71	74.88	54.50	74.09
HN28-S	122.82	49.24	73.58	50.17	72.65
HN28-I	122.73	49.87	72.86	50.82	71.91
HN29-S	119.04	45.28	73.76	46.28	72.76
HN29-I	116.42	43.59	73.83	44.45	71.97
HN29-D	115.11	NA	NA	44.99	70.12
HN30-S	129.10	54.54	74.56	55.05	74.05
HN30-I	126.27	52.30	73.97	51.46	74.81
USGS	120.84	48.40	72.44	49.27	71.57
GM-6S	134.30	59.76	74.54	60.42	73.88
GM-6I	124.72	55.22	69.50	56.03	68.69
GM-7S	127.51	54.06	73.45	54.99	72.52
GM-7I	127.44	54.44	73.00	55.34	72.10
GM-7D	127.64	55.49	72.15	56.63	71.01
GM-8S	127.19	52.05	75.14	52.89	74.30
GM-8I	127.09	52.45	74.64	53.15	73.94
HN-8D	125.91	NA	NA	54.50	71.41
GM-12S	120.55	48.10	72.45	48.85	71.70
GM-12I	120.51	48.35	72.16	49.18	71.33
GM-13S	115.88	43.21	72.67	44.70	71.18
GM-13I	115.75	43.85	71.90	44.57	71.18
GM-13D	113.97	45.02	68.95	45.96	68.01

NA = Not measured (wells were not yet installed)

The degree of confinement within the Magothy aquifer is reported to generally increase with depth due to stratification and the increasing presence of clay and silt. These finer grained sediments occur in lenses that are laterally discontinuous and individually do not constitute confining layers, but their cumulative effect through a thick vertical sequence is believed to significantly impede groundwater movement (Isbister, 1966; McClymonds and Franke, 1972).

As discussed, the intermediate and deep drilling programs at NWIRP confirm both the regional trend of an increase in silts and clays with depth within the Magothy and the irregular distribution of these lenses. Three intermediate wells (HN-24I, HN-28I, and HN-30I) are screened just below significant clay layers (Figures 3-1 and 3-2). Well 28I may even be considered as screened in a sand lens within a particularly clayey or fine-grained interval. As discussed above, however, the static water level elevations between these intermediate wells and the shallow wells of the same clusters are very similar (0.37 feet, 0.72 feet, and 0.59 feet, respectively), indicating unconfined conditions and hydraulic communication between the sands.

3.3.3 Groundwater Flow Characteristics

3.3.3.1 <u>Horizontal Flow</u>

Most of Long Island is bisected by an east-west trending, regional groundwater divide. The NWIRP lies to the south of this divide. Groundwater beneath the site flows in a generally southward direction, toward the Atlantic Ocean. Most published data indicate that local groundwater flow is to the south and southeast. Geraghty and Miller, however, in its work plan for the surrounding Grumman complex, reported that recent data from local sources indicate a consistent horizontal flow direction to the south and southwest (Isbister, 1966; G&M, 1990).

The groundwater flow paths beneath the NWIRP and adjacent grounds are illustrated in Figures 3-5, 3-6, 3-7, and 3-8. Flow directions were determined through the static water elevations of the monitoring well network and were calculated for the water table (Figures 3-5 and 3-7) and the intermediate zone (100- to 150-foot depth) of the Magothy Formation (Figure 3-6 and 3-8) for December 1991 and January 1992. The iso-elevation lines were generated via direct interpolation between individual data points.

The groundwater flow dynamics beneath the NWIRP are complex. Seven deep (357 to 560 feet) production wells, each with a capacity of 1200 gpm, are located on the NWIRP (see Table 3-1 and Figure 3-4).

Nine others are located both up- and downgradient of the NWIRP on Grumman property. According to plant personnel, these wells operate on a pressure-controlled, as-needed basis. Therefore, any particular well may be turned on and off at frequent intervals, or may be turned on or off for extended periods. The resultant cones of depression formed by the possible well-usage combinations make local variations in the overall groundwater flow pattern difficult to predict.

The local groundwater flow pattern is also greatly influenced by the recharge basins located on the NWIRP. Here, the groundwater pumped by the facility wells is recharged to the aquifer through the recharge basins. The basins additionally receive storm runoff drainage. This influx of large quantities of water creates a "mounding" or local high, of the water table. The amount of water recharged through these basins is dependent on the amount of water withdrawn by the wells (generally greater in warmer weather) and the amount of precipitation.

The water-table configuration beneath the NWIRP is illustrated in Figures 3-5 and 3-7. The dominant direction of shallow groundwater flow is to the southwest and, to a lesser extent, to the south. Some radial flow from the mounding may introduce a minor component of eastward flow to Site 2 and westward flow to Site 3, but this most likely does not persist for any appreciable distance. The flow beneath Site 1 is dominantly to the southwest and south.

The horizontal gradients across the NWIRP are very low. As would be expected, the highest gradients are located near the recharge basin. The gradient across the site, as measured from well GM-8S in the north to GM-13S in the south, is approximately 5.3 feet per mile. This is much lower than the reported regional gradient of 10 feet per mile (Isbister, 1966).

The average linear velocity of the groundwater at the water table is approximately 0.9 ft/day in the glacial deposits and 0.2 ft/day in the Magothy Formation (Fetter, 1988). These values were calculated using the average hydraulic conductivities reported earlier and an assumed effective porosity of 30 percent. Both average linear velocities are several orders of magnitude lower than the 50 to 70 ft/day predicted in the Initial Assessment Study (RGH, 1986).

The groundwater flow (potentiometric surface) within the Magothy Formation (subsurface depth of 100 to 150 feet) is illustrated in Figures 3-6 and 3-8. The flow at this depth is apparently affected by both the well pumpage and the recharge basins. The groundwater beneath Site 1 and Site 2 flows in a predominantly south- to southwestward direction, similar to the flow at the water table. Groundwater beneath Site 3, however, exhibits a strong westward component due to the apparent effects of pumping at well 8454.

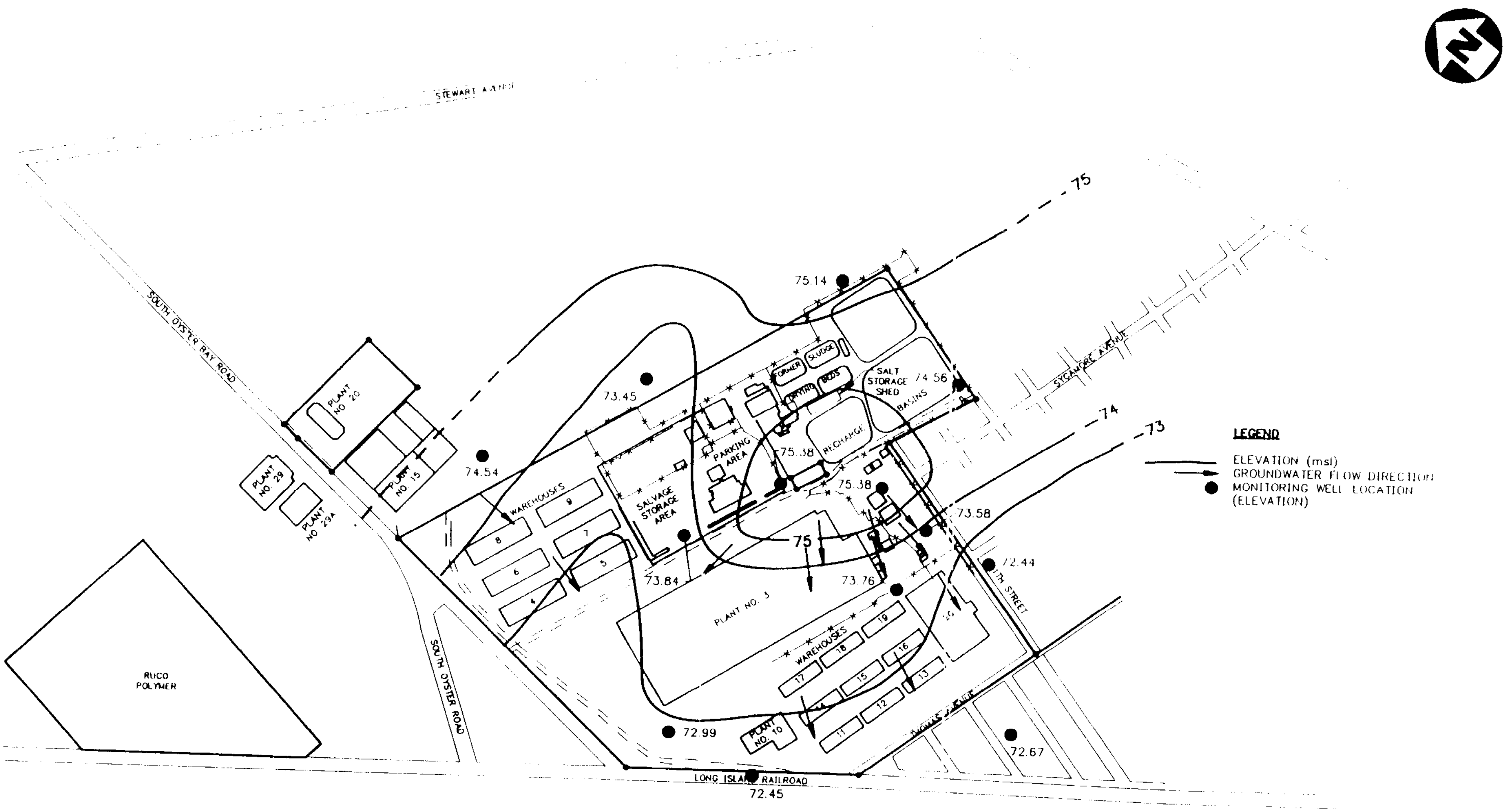


FIGURE 3-5

SHALLOW MAGOTHY AQUIFER (SHALLOW WELLS) DECEMBER 18, 1991
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

3-15

HALLIBURTON NUS
Environmental Corporation

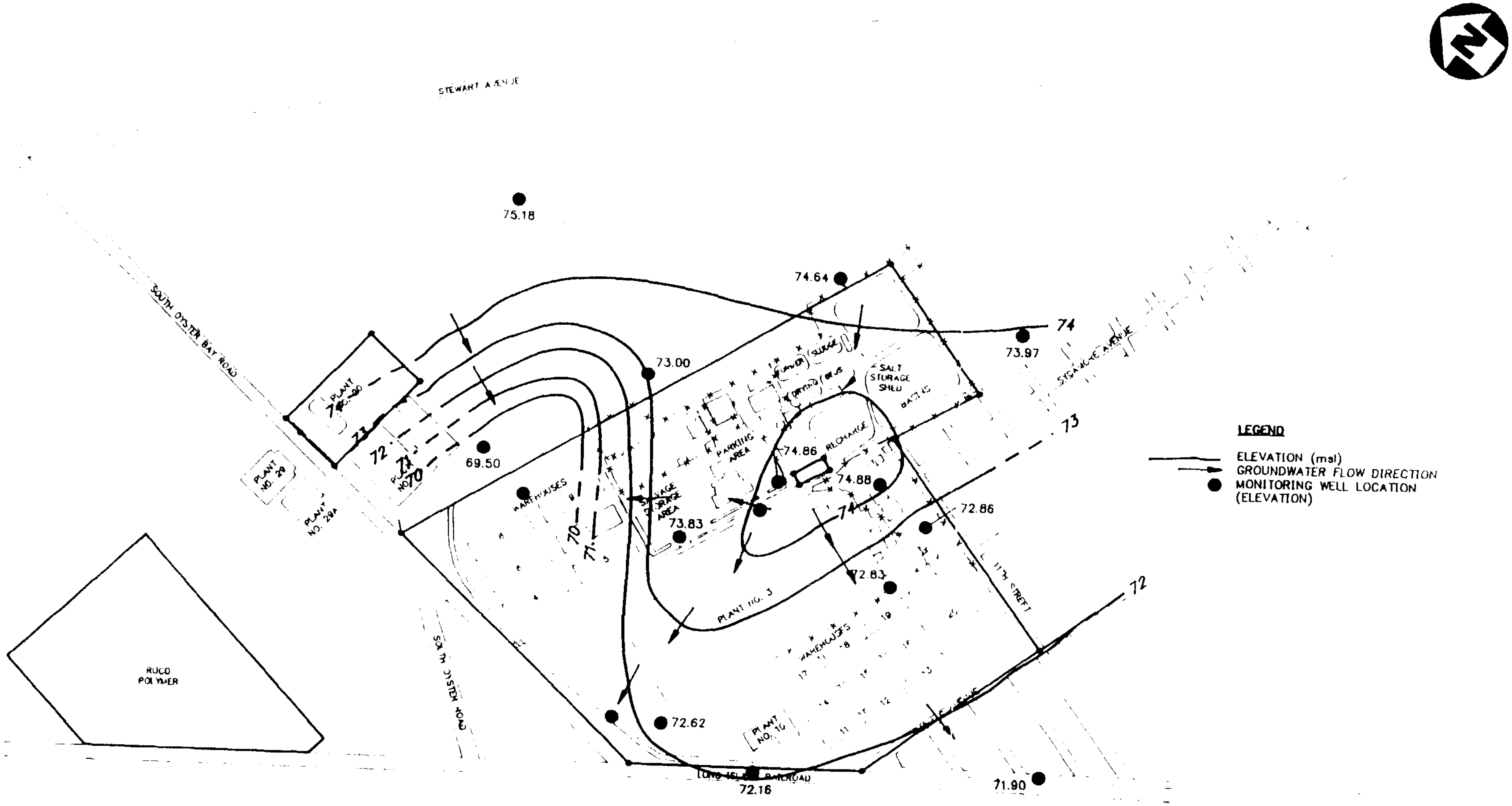


FIGURE 3-6

MAGOTHY AQUIFER (INTERMEDIATE WELLS) DECEMBER 18, 1991
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

3-17

HALLIBURTON NUS
Environmental Corporation

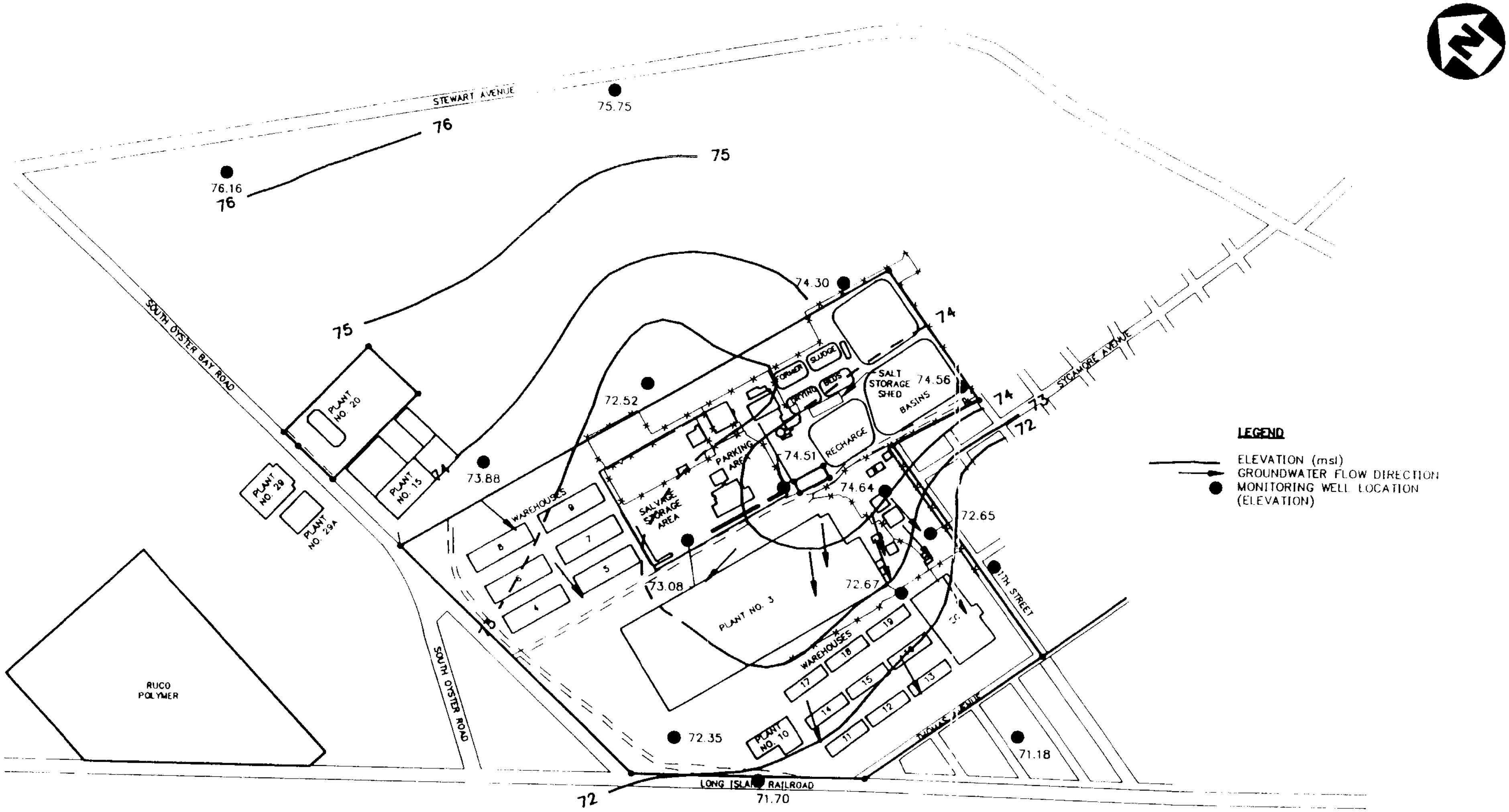


FIGURE 3-7

SHALLOW MAGOTHY AQUIFER (SHALLOW WELLS) JANUARY 24, 1992
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation

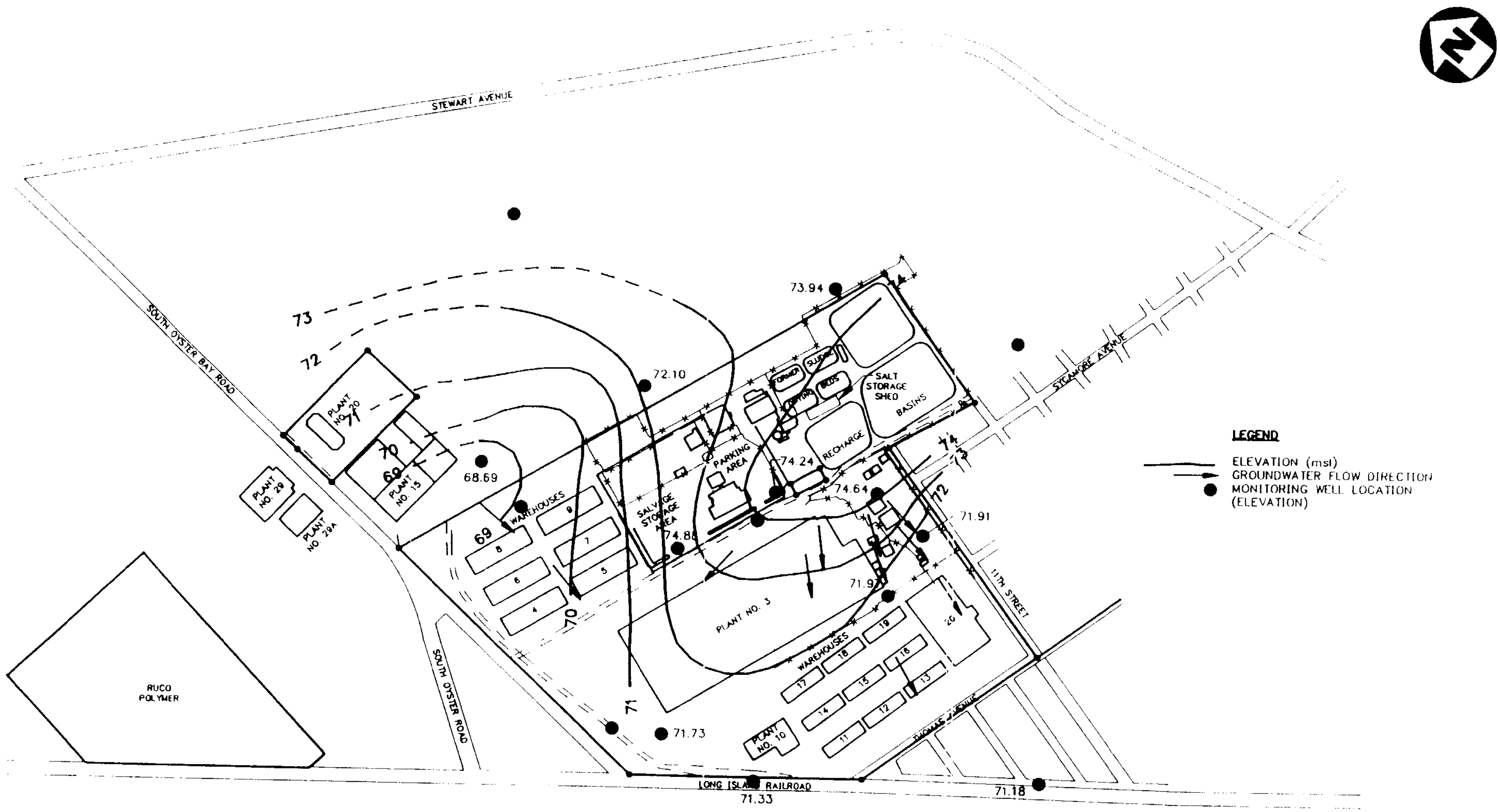


FIGURE 3-8

MAGOTHY AQUIFER (INTERMEDIATE WELLS) JANUARY 24, 1992
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

3-21

HALLIBURTON NUS
Environmental Corporation

As discussed, the Grumman facility wells may operate in many possible combinations. Because of this, the groundwater flow directions may vary locally, and any flow analysis can only be considered as representative for that particular time. For instance, neither well no. 7636 nor well no. 7637 was operating on December 18, due to low demand. Had they been pumping, the groundwater beneath Site 3 would have most likely have exhibited a much stronger component of southward, or regionally downgradient, flow.

The horizontal gradients within the Magothy aquifer vary in magnitude across the NWIRP. As evident from Figure 3-6, they are greatest near points of discharge and recharge. The gradient across the site away from these points (as measured from well GM-8I in the north to GM-13I in the south), is approximately 5.3 foot per mile.

3.3.3.2 Vertical Flow

The static water elevations for the well clusters at the NWIRP (Table 3-2) indicate that the activity occupies an area of groundwater recharge. The vertical gradients at each site are in a downward direction, but are very low. As would be expected, the steepest gradients are located near points of recharge or discharge (well cluster GM-6, for example). The low vertical gradients beneath the activity are consistent with the regional pattern as reported in the literature (Isbister, 1966).

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of environmental contamination at the Bethpage NWIRP site is discussed in this section. The validated analytical data generated during the 1991 Remedial Investigation provide the basis for this discussion. The complete analytical data base to date is included as Appendix H. The remainder of this section is structured by site and by the types of investigative activities at each site. Section 4.1 presents the results of the investigation at Site 1. Similarly, Section 4.2 and Section 4.3 present the results of the investigations for Sites 2 and 3, respectively.

4.1 Former Drum Marshaling Area (Site 1)

4.1.1 Soil-Gas

Soil-gas sampling was done to help define the extent of volatile organic contamination and to assist in the selection of sampling locations. The analysis included the parameters of 1,1-dichloroethene (1,1-DCE), trans-1,2-dichloroethene (t-1,2-DCE), 1,1-dichloroethane (1,1-DCA), cis-1,2-dichloroethene (c-1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), trichloroethene (TCE), and tetrachloroethene (PCE). Of these parameters, TCE and PCE were used as indicator chemicals. The concentrations referred to in this section are a sum of these two concentrations. Soil-gas sampling locations and results are presented in Figures 4-1 and 4-2.

Site 1 contained the highest soil-gas readings of the three sites (see Table 4-1 for soil-gas results at Site 1). DCE readings were as high as 728 ug/l in the deep samples and 832 ug/l in the shallow samples. Total TCE+PCE readings were greater than 100 ug/l. The high concentration readings in the shallow samples are located at the former drum marshaling area. This may be a result of surface spills. The high concentrations in the deep samples occur in the former drum marshaling area and downgradient of the former drum marshaling area. This may be due to outgassing of a plume that has migrated downgradient. One interesting result is the relatively "clean" analysis at location 110. This point corresponds to the most contaminated shallow groundwater sampled by either the temporary well points or the permanent monitoring wells. It is hypothesized that the numerous thin, clayey intervals at this location (as observed in the borings) may prevent the upward migration of the gas-phase contaminants.

QA/QC samples are also presented in Table 4-1. Analysis of the field control sample (blank) and laboratory blank results indicated minimal background contamination. The duplicate results were generally within +/- 30%. These results indicate that the data is of relatively good quality.

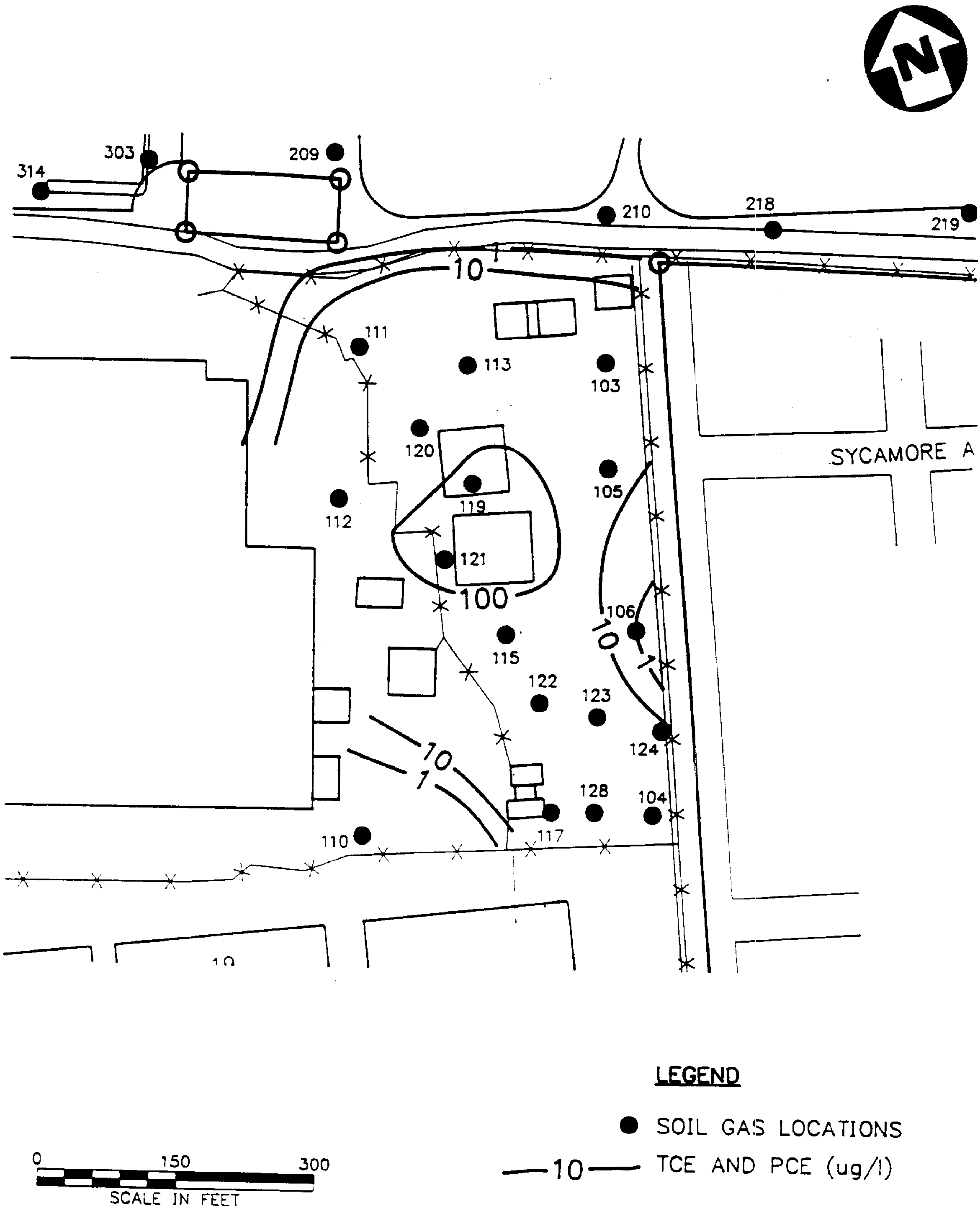


FIGURE 4-1

SOIL GAS RESULTS - SHALLOW
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

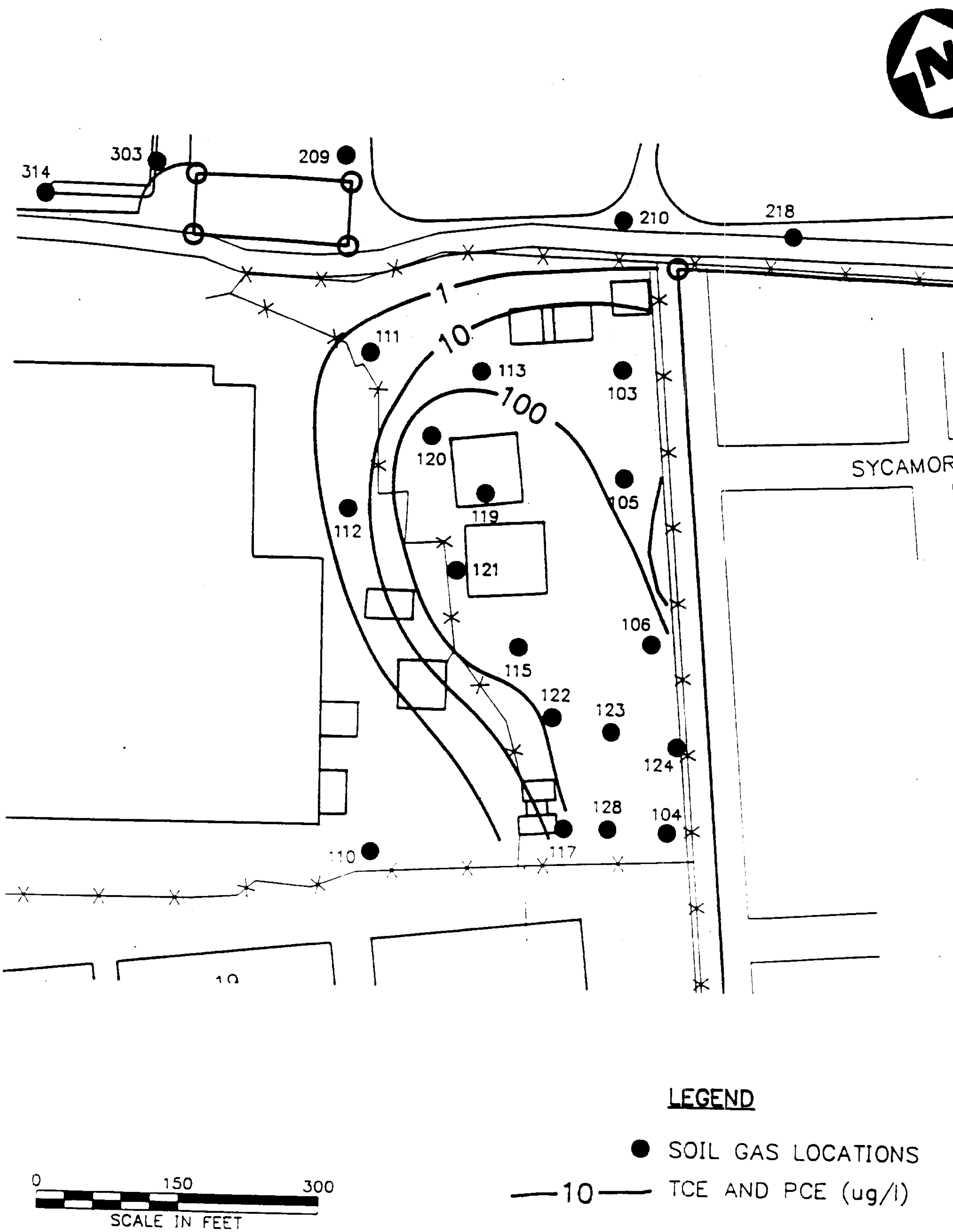


FIGURE 4-2

SOIL GAS RESULTS - DEEP
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NU
Environmental Corporati

TABLE 4-1
SOIL-GAS RESULTS - SITE 1 (ug/l)
NWIRP, BETHPAGE, NY

Sample	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
103D	192	<1.0	2.7	1.6	18	15	11
103S	44	<1.0	<1.0	3.6	5.6	13	9.6
104D	7.4	<1.0	3.7	<1.0	89	143	5.7
104S	<1.0	<1.0	<1.0	<1.0	0.31	0.68	<0.05
105D	244	<1.0	<1.0	<1.0	14	9.7	27
105S	187	<1.0	<1.0	<1.0	9.9	7.7	19
106D	<1.0	<1.0	<1.0	<1.0	0.22	1.2	0.12
106S	6.1	<1.0	<1.0	<1.0	1.6	3.5	3.5
110D	3.6	<1.0	<1.0	<1.0	0.11	<0.10	0.78
110S	<1.0	<1.0	<1.0	<1.0	<1.0	<0.10	0.65
111D	59	<1.0	<1.0	<1.0	6.4	6.7	3.6
111S	125	<1.0	<1.0	<1.0	8.8	7.8	1.9
112D	85	<1.0	1.7	<1.0	9.0	4.9	6.7
112S	61	<1.0	<1.0	<1.0	9.4	3.7	9.4
113D	174	<1.0	<1.0	<1.0	15	11	16
113S	131	<1.0	<1.0	<1.0	8.3	15	12
115D*	80	<1.0	2.4	4.4	8.8	18	<0.05
115S	20	<1.0	<1.0	<1.0	9.5	14	70
117D	14	<1.0	<1.0	<1.0	26	40	21
117S	7.4	<1.0	<1.0	<1.0	10	18	14
119D	165	<1.0	3.1	26	24	21	70
119S	626	<1.0	6.9	37	70	63	138
120D	728	<1.0	18	16	107	45	174
120S	832	<1.0	30	48	122	68	479
121D	558	<1.0	19	50	101	96	617
121S	568	<1.0	21	48	125	159	765
122D	46	<1.0	<1.0	<1.0	19	19	77
122S	8.6	<1.0	<1.0	<1.0	6.4	17	35
123D	11	<1.0	3.9	<1.0	78	139	19
123S	4.9	<1.0	<1.0	<1.0	39	56	14
124D	11	<1.0	<1.0	<1.0	13	16	20
124S	2.7	<1.0	<1.0	<1.0	2.4	1.2	4.8

TABLE 4-1
SOIL-GAS RESULTS - SITE 1 (ug/l)
PAGE TWO

Sample	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
FIELD CONTROL SAMPLES							
101	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
102	<1.0	<1.0	<1.0	<1.0	<0.10	0.14	<0.05
107	<1.0	<1.0	<1.0	<1.0	<0.10	0.11	<0.05
108	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
109	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
114	<1.0	<1.0	<1.0	<1.0	<0.10	<0.1	0.09
125	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.40
LABORATORY DUPLICATE ANALYSES							
106D	<1.0	<1.0	<1.0	<1.0	0.22	1.2	0.12
106DR	<1.0	<1.0	<1.0	<1.0	0.20	1.3	0.13
110D	3.6	<1.0	<1.0.	<1.0	0.11	<0.10	0.78
110DR	3.1	<1.0	<1.0	<1.0	<0.10	<0.10	0.47
113D	174	<1.0	<1.0	<1.0	15	11	16
113DR	165	<1.0	<1.0	<1.0	14	7.4	15
LABORATORY BLANKS							
106DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
110DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
113DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

* = SAMPLES MAY CONTAIN HIGHER CONCENTRATIONS OF 111TCA, TCE, AND/OR PCE

11DCE = 1,1-dichloroethene
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
111TCA = 1,1,1-trichloroethane
TCE = trichloroethene
PCE = tetrachloroethene

S = Shallow
D = Deep

4.1.2 Temporary Monitoring Wells

Ten temporary wells at Site 1 were sampled and analyzed for volatile organics including vinyl chloride, 1,1-DCE, t-1,2-DCE, 1,1-DCA, c-1,2-DCE, 1,1,1-TCA, 1,2-dichloroethane (1,2-DCA), TCE, and PCE. The locations of the temporary monitoring wells are presented in Figure 2-2. A summary of the organic contaminants detected at Site 1 is provided in Table 4-2.

As evidenced on the above-referenced table, groundwater at Site 1 had the highest concentration readings and greatest number of contaminants detected in temporary wells at the NWIRP. Site 1 also contained the two most contaminated wells: G-110 (located downgradient of the Site 1), and G-121 (located in the middle of the site). PCE was present at a maximum concentration of 7,700 ug/l in temporary well G-121. It was also found at concentrations greater than 700 ug/l in temporary wells located in the former drum marshaling area and in the downgradient direction. TCE was present at a maximum concentration of 1,900 ug/l in well G-123. It was also found at concentrations greater than 100 ug/l in temporary wells located in the former drum marshaling area and in the downgradient direction. 1,1,1-TCA was present at a maximum concentration of 5,400 ug/l in temporary well G-110. It was also present at concentrations greater than 100 ug/l in the former drum marshaling area and in the downgradient direction. c-1,2-DCE was present at a maximum concentration of 1,600 ug/L in well G-110. It was also present at concentrations greater than 100 ug/l in temporary wells located in the source area. 1,1-DCA was present at a maximum concentration of 630 ug/l in temporary well G-110. It was also present at concentrations of greater than 100 ug/l in the former drum marshaling area and in the downgradient direction. 1,1-DCE was present at a maximum concentration of 100 ug/l at temporary well G-110. It was also found in lesser concentrations in the former drum marshaling area and in the downgradient direction.

4.1.3 Subsurface Soils

Subsurface soil sample locations are presented in Figure 2-3. Table 4-3 presents the distribution of organic chemicals in subsurface soil. Low-level volatile organic chemicals (VOCs), especially TCE and PCE, were detected. Figures 4-3, 4-4, and 4-5 illustrate the subsurface distribution of detections of TCE, PCE, and 1,1,1-TCA. For the 3-foot depths of SB-113, SB-119, and SB-121, PCE was detected at 25 ug/kg, up to 4,800 ug/kg, and up to 26 ug/kg, respectively; it was also detected at 12 ug/kg at the 19-foot depth of SB-119. TCE at the 3-foot depth of SB-119 was detected at 200 ug/kg. Sample SB-119 was located in former drum marshaling area no. 2. In general, concentrations of compounds in samples obtained at 19 feet were not significantly greater than concentrations at 3 feet. There appears to be overall trace to low-level chlorinated ethene contamination at Site 1.

TABLE 4-2

TEMPORARY MONITORING WELL RESULTS (ug/l) - SITE 1
NWIRP, BETHPAGE, NY

Temporary Well No.	VC	11DCE	T12DCE	11DCA	C12DCE	111TCA	112DCA	TCE	PCE
103	5U	5U	5U	5U	5U	5U	5U	28	5U
104	5U	5U	5U	5U	5U	94	5U	370	18
110	25U	25U	25	630	1600	5400	25U	950	5200
111	5U	5U	5U	5U	5U	5U	5U	5U	5U
112	5U	5U	5U	5U	5U	12	5U	10	5U
113	5U	5U	5U	5U	5U	8	5U	9	8
115	5U	5U	5U	43	150	180	5U	260	2000
119	5U	5U	5U	22	85	240	5U	280	1100
121	25U	25U	25U	110	540	110C	25U	1800	7700
123	5U	7	5U	22	48	200	5U	1900	780

U - Undetected
11DCE = 1,1-dichloroethene
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
111TCA = 1,1,1-trichloroethane
TCE = trichloroethene
PCE = tetrachloroethene
VC = vinyl chloride

TABLE 4-3

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS
SITE 1 - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

Compound	CRQL	Number Positive Detections/ Samples Analyzed	Location of Maximum Concentration	Maximum Positive Concentration	Representative Concentration*
Trichloroethene	5	2/18	SB119	200J	36.5
Tetrachloroethene	5	16/18	SB119	4800J	834
1,2-Dichloroethene	5	1/18	SB119	6	3.1
1,1,1-Trichloroethane	5	1/18	SB119	72	14.5
Di-n-butyl phthalate	330	2/9	SB112	16J	16
Butyl benzyl phthalate	330	1/9		97.5	97.5
TIC PCBs	-	1/9	SB121	P	-

Background soil concentrations are provided in Table 4-4.
* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
\- = Not Detected
CRQL = Contract Required Quantitation Limit
P = Present

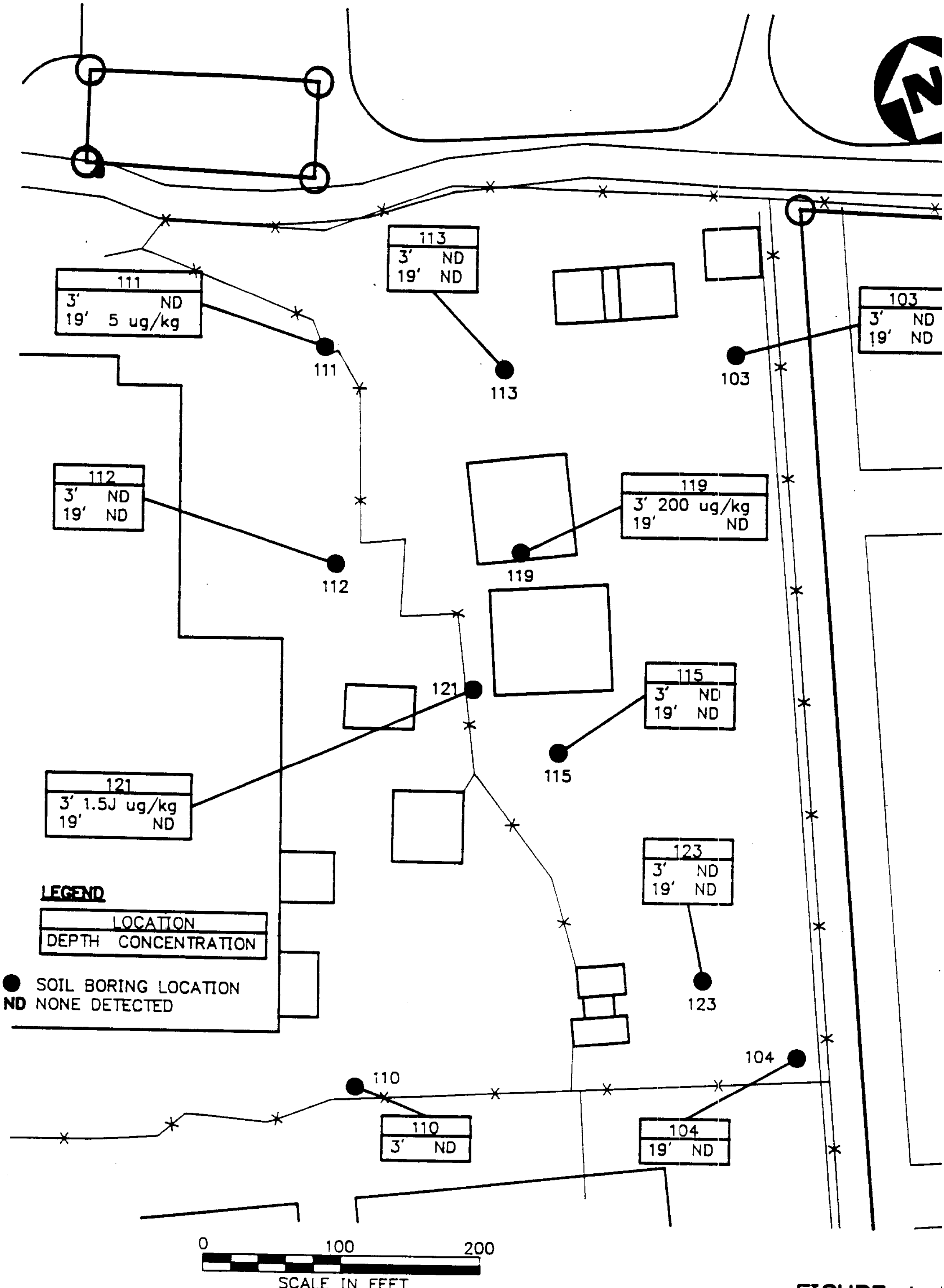


FIGURE 4-

SITE 1 - SUBSURFACE SOIL RESULTS - TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON N
Environmental Corporat

ACAD: 3281\SITE1.DWG 02/29/92 MB 4-3.LAY

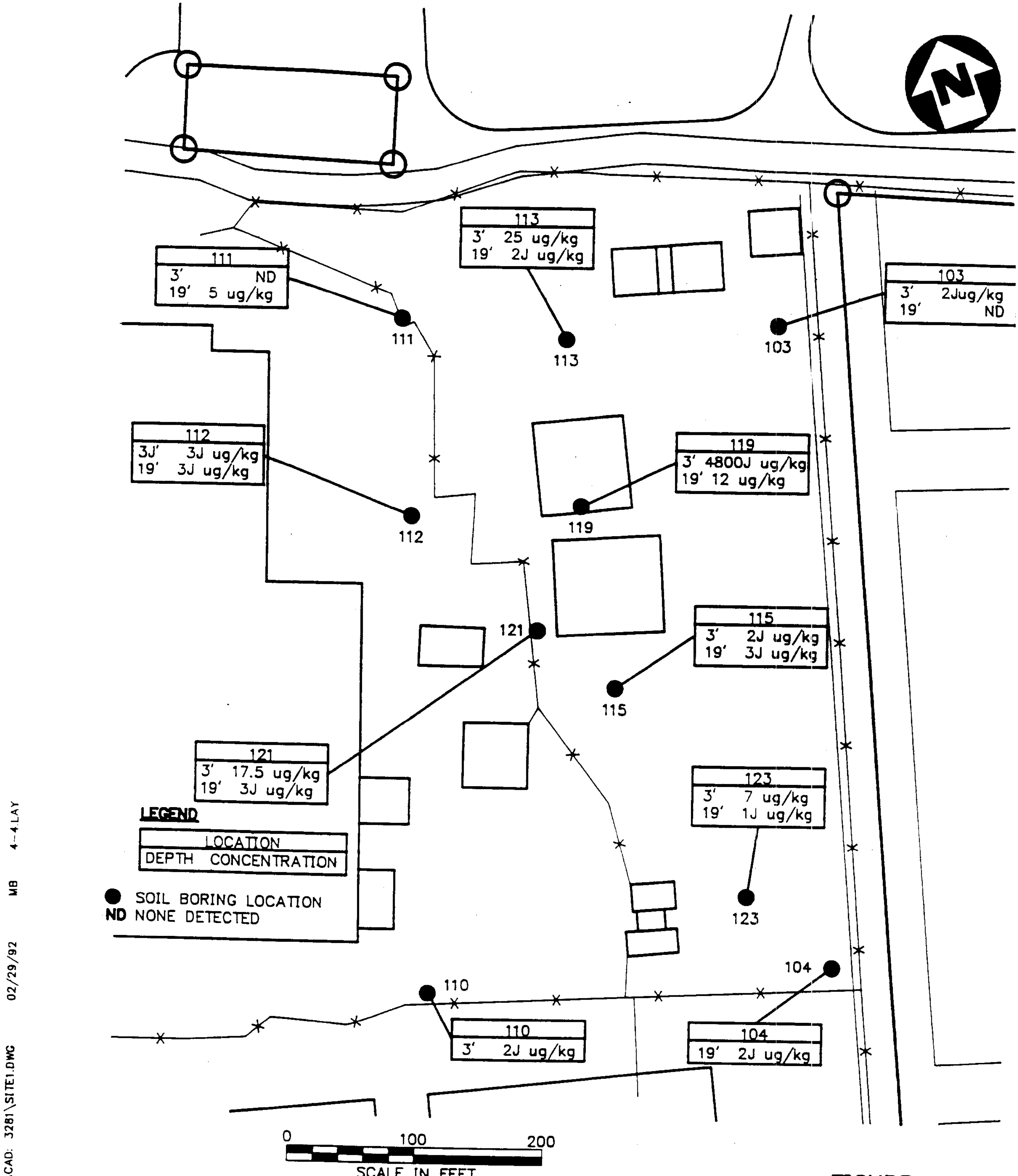
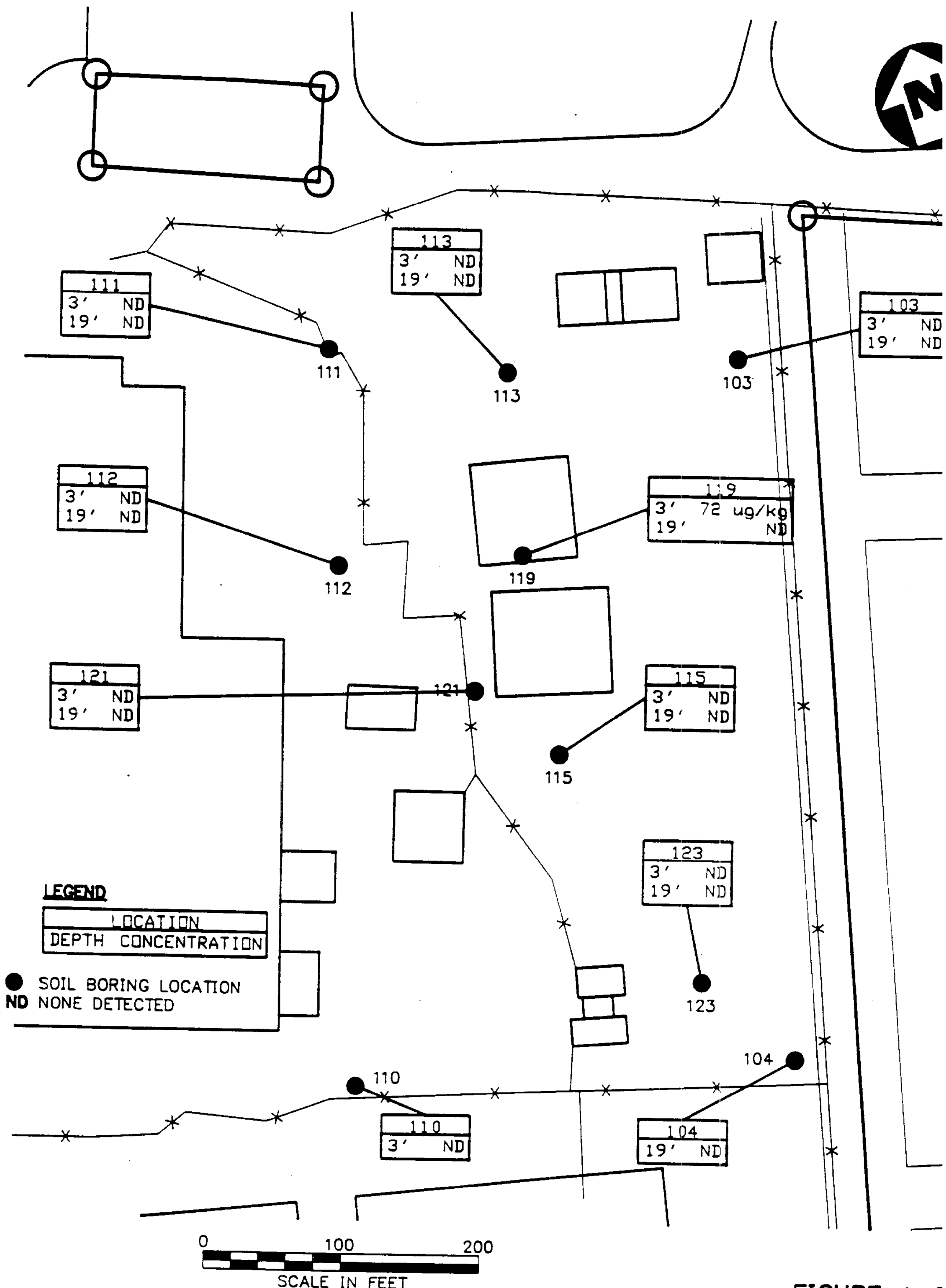


FIGURE 4-4

SITE 1 - SUBSURFACE SOIL RESULTS - PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation



ACAD: 3281\SITE1.DWG 02/27/92 MB 4-5.LAY

FIGURE 4-5

SITE 1 – SUBSURFACE SOIL RESULTS – 1,1,1,-TCA
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NU
Environmental Corporat

PCBs were tentatively identified at one location at Site 1 (121, 3-foot depth). Phthalate, which are plasticizers and are also common environmental contaminants as well as common blank contaminants, were detected at low concentrations at one location at Site 1. PCBs as TICs are used mainly on a confirmation basis. TICs are not appropriate for quantitative risk assessment because their identities and quantities are uncertain (quantities may vary by an order of magnitude). Those PCBs and phthalate that were confidently identified are addressed quantitatively in Section 6.0. The TOX profiles in Appendix I contain quantitative information about the toxicity of PCBs and phthalate.

Chlorinated solvents were detected at trace levels in background soil samples (See Table 4-4). PAHs were also detected in background soil samples, up to approximately 7000 ug/kg.

Since inorganic parameters are commonly found in most soils, typically a background concentration for each chemical is determined. Table 4-5 presents the results of background (subsurface) soil inorganic analyses. All background samples were located north (upgradient) of the three sites. The mean, standard deviation, and maximum results for each element are shown. Also shown is the 95% upper confidence limit ["B", which equals mean + (1.645) (standard deviation)]. The maximum and B values are then compared to onsite inorganic soil results. Results rejected during data validation were not used. These comparisons will be used in Section 6.0 in the selection of the chemicals of concern.

Table 4-6 displays inorganic analytical results for subsurface soil at Site 1. The highest-concentration sample in Site 1 was one of a field duplicate pair at SB-121; this was located roughly in the center of Site 1, southwest of the former drum marshaling areas. However, the high arsenic result and the high result for cyanide in SB-119 are also notable. SB-119 is located at drum marshaling area No. 2.

4.1.4 Groundwater Data

The monitoring well sample locations are displayed on Figure 2-5. For Site 1, monitoring HN-27 and, to a limited extent, HN-26 served as the upgradient monitoring wells. Monitoring well HN-28, HN-29, and, to an extent, the USGS well served as downgradient monitoring wells. The results of the organic analyses of monitoring wells are presented in Table 4-7. Groundwater contamination by the VOCs TCE, 1,1,1-TCA, and PCE is illustrated in Figures 4-6, 4-7, and 4-8 for shallow-screened wells and in Figures 4-9, 4-10, and 4-11 for wells screened at intermediate depths. The isoconcentration lines were generated via direct interpolation between individual data points. The distribution of organic contaminants detected above maximum contaminant levels (MCLs) is displayed on Figures 4-12 and 4-13.

TABLE 4-4

BACKGROUND SOIL CONTAMINANTS - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

Chemical	CRQL	SB202	SB204	SB205	SB329
Trichloroethene	5		1J		
1,1,2-Trichloroethane (TIC)	-		P	P	
Tetrachloroethene	5				4J
Carbon disulfide	5				1J
Phenanthrene	350				1030
Fluoranthene	350				1060
Pyrene	350				1000
Benzo[b]fluoranthene	350				450
Benzo[k]fluoranthene	350				410
Benzo[a]pyrene	350				540
Indeno[1,2,3,-c,d]pyrene	350				340J
Benzo[g,h,i]perylene	350				300J
Benzo[a]anthracene	350				510
Chrysene	350				510
Acenaphthene	350				270J
Naphthalene	350				61J
Dibenzofuran	350				68J
Fluorene	350				160J
Anthracene	350				230J
PAH (TIC)	-				P

PAH = Polynuclear aromatic hydrocarbon
TIC = Tentatively identified compound
* = A blank indicates that the compound was not detected
CRQL = Contract Required Quantitation Limit
J = Estimated
P = Present

TABLE 4-5

BACKGROUND SUBSURFACE SOIL RESULTS - INORGANICS (mg/kg)
NWIRP, BETHPAGE, NY

Element	CRDL	IDL	SB202	SB204	SB205	SB329	MEAN	STD	B	MAX
Aluminum	40	36.2	6350	9370	2900	10100	7180	3269	12558	10100
Antimony	12	2.9/4.9	-	-	-	<5.5	NC	NC	NC	<5.5
Arsenic	2	0.78	1.5J	2.9J	3J	2.6	2.5	0.68	3.6	3
Barium	40	1.7	14.9	29.9	6.2	22.6	18.4	10.13	35.1	29.9
Beryllium	1	0.76	<0.8	<0.84	<0.98	-	NC	NC	NC	<0.98
Cadmium	1	0.94	<0.99	<1.0	<1.2	<1.1	NC	NC	NC	<1.20
Calcium	1000	58.2	80.1	32*	37.35*	583	183	266	621	583
Chromium	2	2.1	-	-	-	12.7J	NC	NC	NC	12.7
Cobalt	10	4.4	-	-	<5.6	<4.9	NC	NC	NC	<5.6
Iron	20	7.0	-	-	-	11400	NC	NC	NC	11400
Lead	0.6	0.38/0.44	-	-	-	7.8	NC	NC	NC	7.8
Magnesium	1000	27.4	1030	1560	522	1080	1048	423	1743	1560
Manganese	3	1.0	-	-	-	167J	NC	NC	NC	167
Mercury	0.1	0.10	0.05*	0.055*	0.14	0.055*	0.075	0.04	0.15	0.14
Nickel	8	4.8	<5.0	-	<6.2	<5.4	NC	NC	NC	<6.2
Potassium	1000	72.0	478	644	503	353	494	119	690	644
Selenium	1	1.0	<1.0	<1.1	<1.3	<0.56	NC	NC	NC	<1.30
Silver	2	0.18/0.24	<0.25	<0.26	<0.31	<0.2	NC	NC	NC	<0.31
Sodium	100	48.0	-	-	-	190	NC	NC	NC	190
Thallium	2	0.64	<0.67	<0.7	<0.82	<0.72	NC	NC	NC	<0.82
Vanadium	10	3.7	-	-	-	17.9J	NC	NC	NC	17.9
Zinc	4	3.1	-	-	-	20	NC	NC	NC	20
Cyanide	2	2.0	<2.1	<2.2	<2.6	<2.25	NC	NC	NC	<2.60

MEAN = Arithmetic mean
STD = Standard deviation, with n-1 samples
MAX = Maximum reported background
B = 95% Upper Confidence Limit [(MEAN + (1.645) * (STD)]
NC = Not calculated
CRDL = Contract Required Detection Limit
* Reported number is 1/2 detection limit; used for non-detects when at least one other reported result is positively detected.
IDL = Instrument Detection Limit

TABLE 4-6

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS
SITE 1 - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

Element	CRDL	IDL	Number Positive Detections/ Samples Analyzed	Location of Maximum Concentration	Concentration Range	Representative Concentration*
Aluminum	40	36.2	9/9	SB112	1010-11429J	6832
Antimony	12	4.9	1/9	SB119	ND-9.8J	5.2
Arsenic	2	0.78	8/9	SB119	ND-3380	1244
Barium	40	1.7	9/9	SB112	4.1-30.73	17.6
Cadmium	1	0.94	2/9	SB103	ND-4.5	2.0
Chromium	2	2.1	9/9	SB112	2.7-10.94J	9.5
Cobalt	10	4.4	1/9	SB112	ND-4.3	3.0
Copper	5	1.7	3/3	SB112	3.1-7.9	7.9
Iron	20	7.0	9/9	SN112	2210-12913	8400
Lead	0.6	0.38	9/9	SB112	1J-5.4J	4.5
Manganese	3	1.0	9/9	SB111	15.1J-167J	126
Mercury	0.1	0.10	1/9	SB112	ND-0.108	0.07
Nickel	8	4.8	2/9	SB112	ND-6.0	4.3
Vanadium	10	3.7	7/9	SB112	ND-17.9	11.8
Zinc	4	3.1	6/6	SB123	8.8-17.9	14.5
Cyanide	2	2.0	2/9	SB119	ND-13.3	6.0
Thallium	2	0.64	1/9	SB112	ND-0.54	0.54

Background soil concentrations are provided in Table 4-5.
* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected
CRDL = Contract Required Detection Limit
IDL = Instrument Detection Limit
J = Estimated Value

TABLE 4-7

POSITIVE DETECTIONS OF ORGANIC GROUNDWATER CONTAMINANTS
SITE 1 (ug/l)
NWIRP, BETHPAGE, NEW YORK

Chemical	CRQL	HN-27S (Upgrad)	HN-28S	HN-28SD (DUP HN28S)	HN-29S	USGS	HN-27I (Upgrad)	HN-28I	HN-29I	HN-29D
Trichloroethene	5	16	1100	1100	780	12	13	9	6	11
Toluene	10				39					
1,1-Dichloroethane	5		29	32	880					4J
1,2-Dichloroethene	5		160	180	3600					7
1,1,1-Trichloroethane	5	8	220	240	10000	4J	3J		2J	48
Tetrachloroethene	5	10	430	360	250	11	2J	2J	2J	10
1,1-Dichloroethene	5		9	10	250					2J
Ethylbenzene	5				3J					
Xylenes	5				19					
Di-n-octylphthalate	10							17		
2-Methylphenol	10				2J					
4-Methylphenol	10				2J					
2,4-Dimethylphenol	10				7J					
Naphthalene	10				3J					
Acenaphthylene	10				1J					
Fluoranthene	10					2J				
Benzo[b]fluoranthene	10					2J				
Pyrene	10					2J				

J = Estimated
CRQL = Contract Required Quantitation Limit

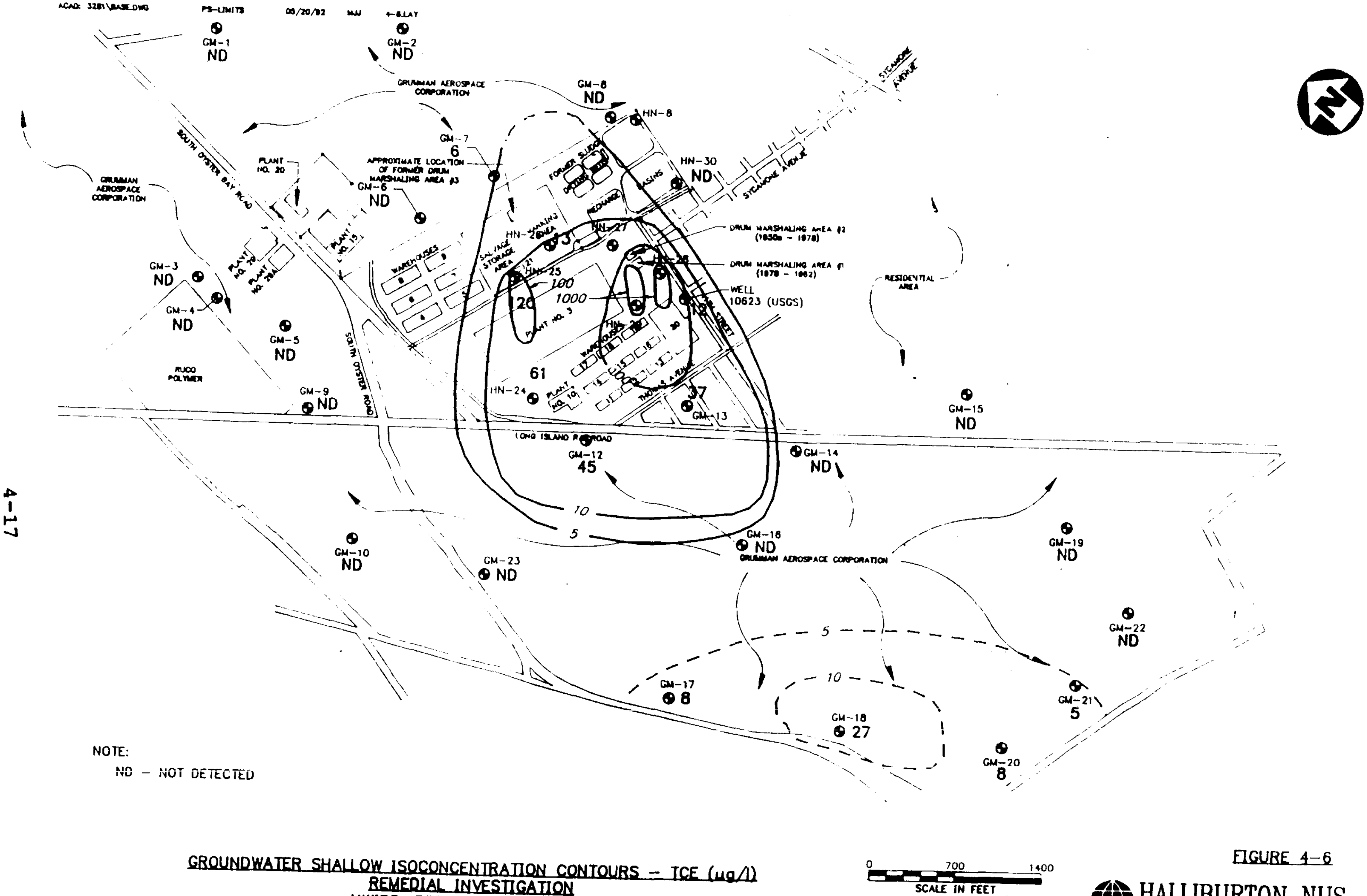
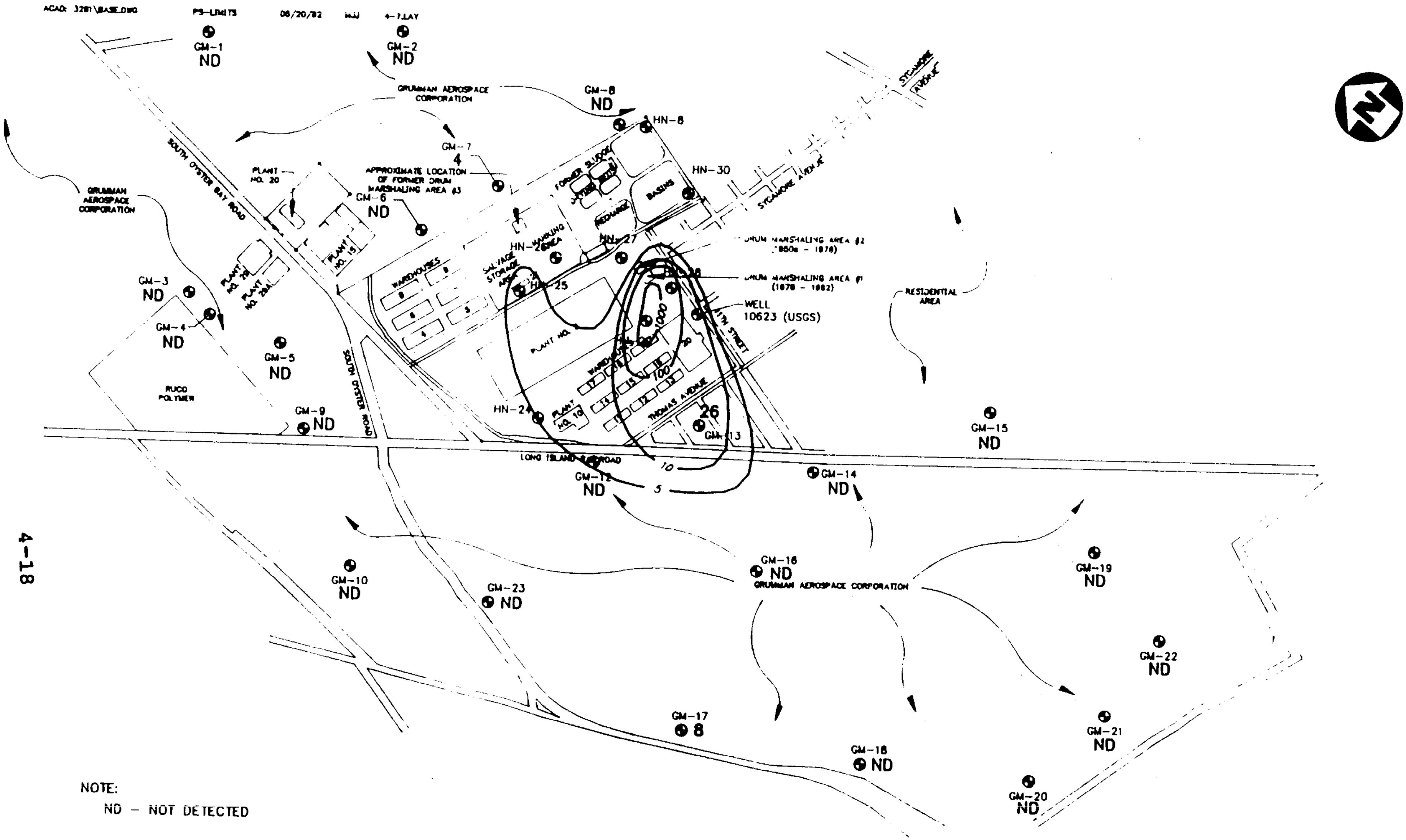


FIGURE 4-6

GROUNDWATER SHALLOW ISOCONCENTRATION CONTOURS - TCE (ug/l)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation



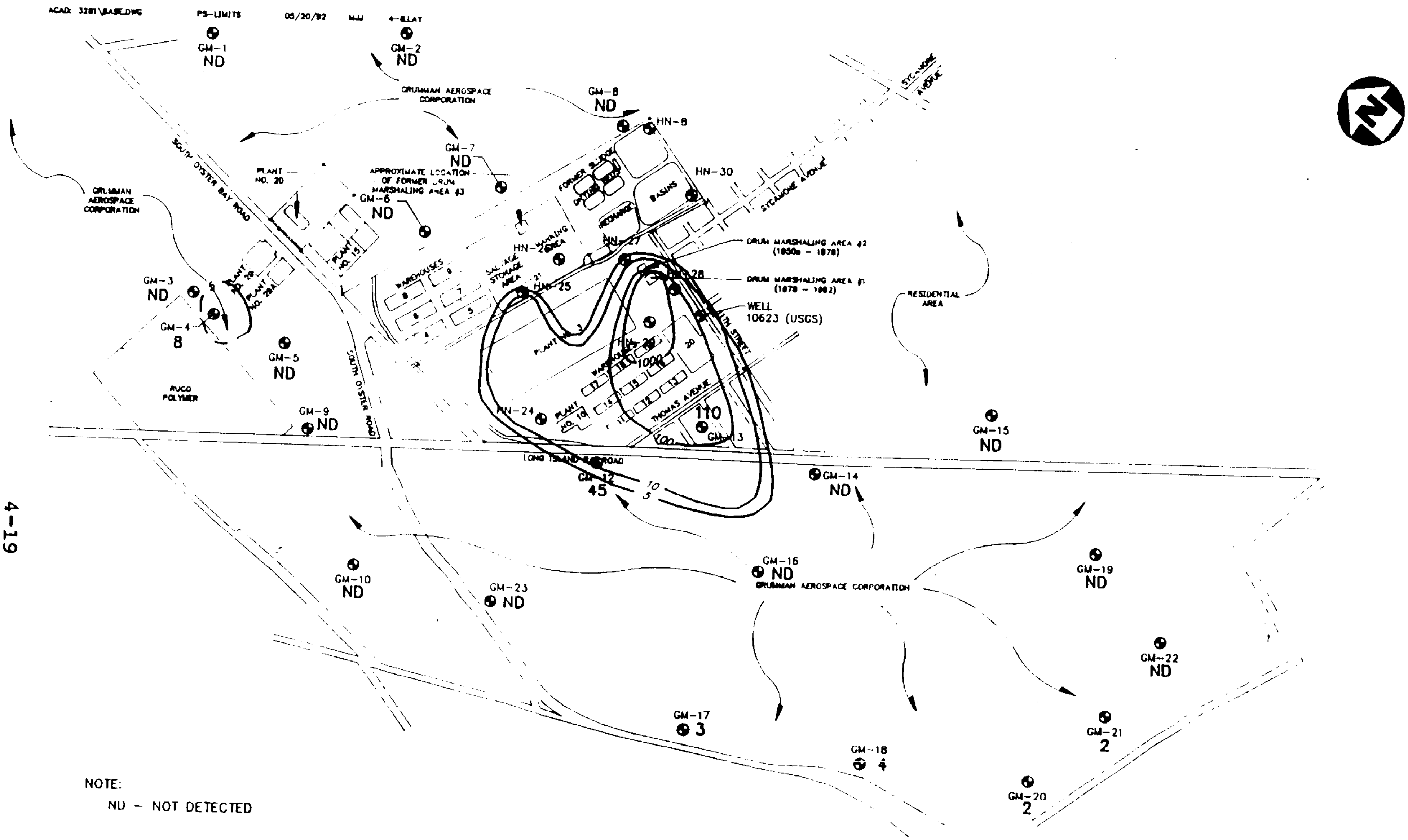
NOTE:
ND - NOT DETECTED

GROUNDWATER SHALLOW ISOCONCENTRATION CONTOURS - 1,1,1-TCA (µg/l)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

0 700 1400
SCALE IN FEET

FIGURE 4-7

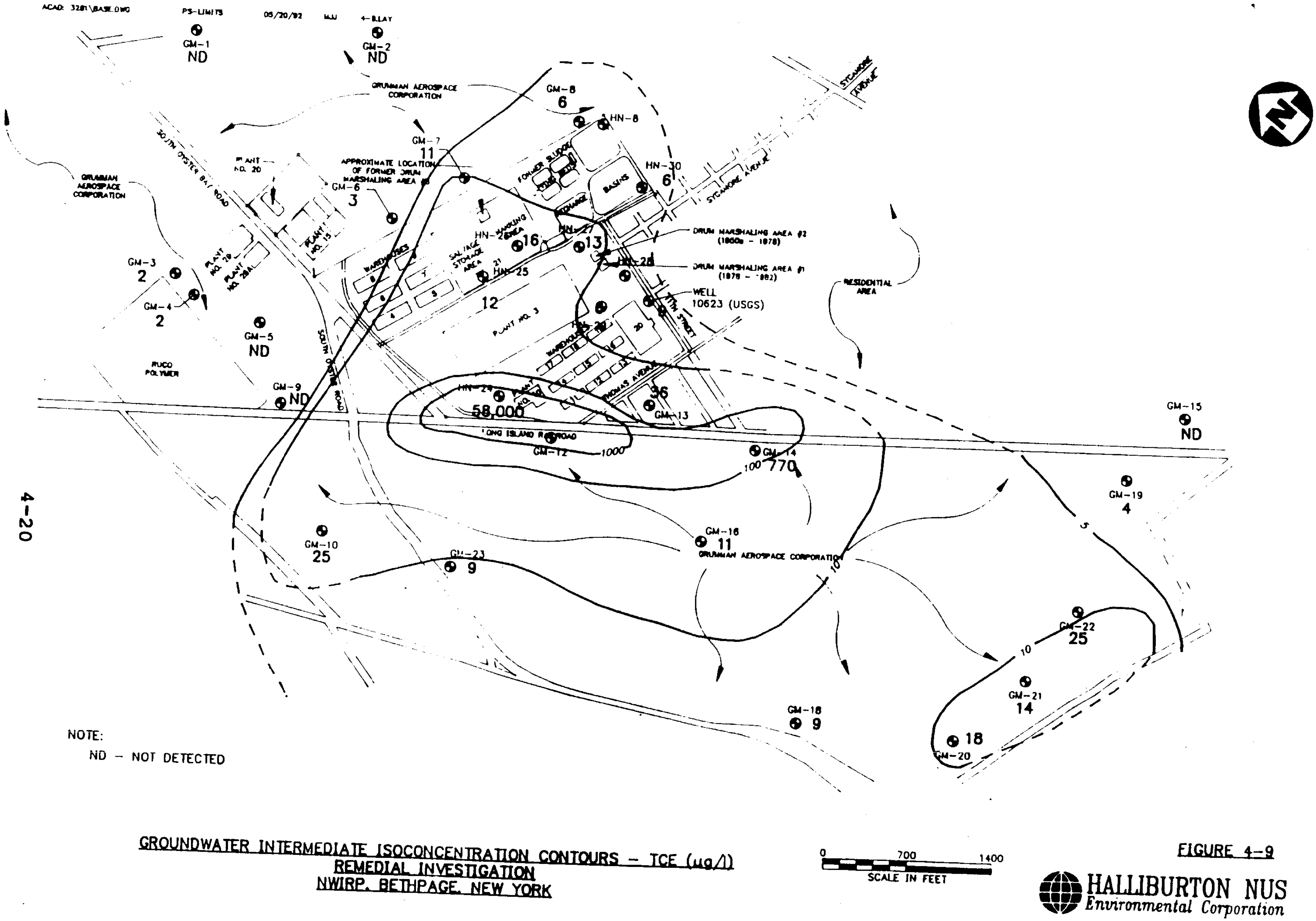
HALLIBURTON NUS
Environmental Corporation



GROUNDWATER SHALLOW ISOCONCENTRATION CONTOURS - PCE (µg/l)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

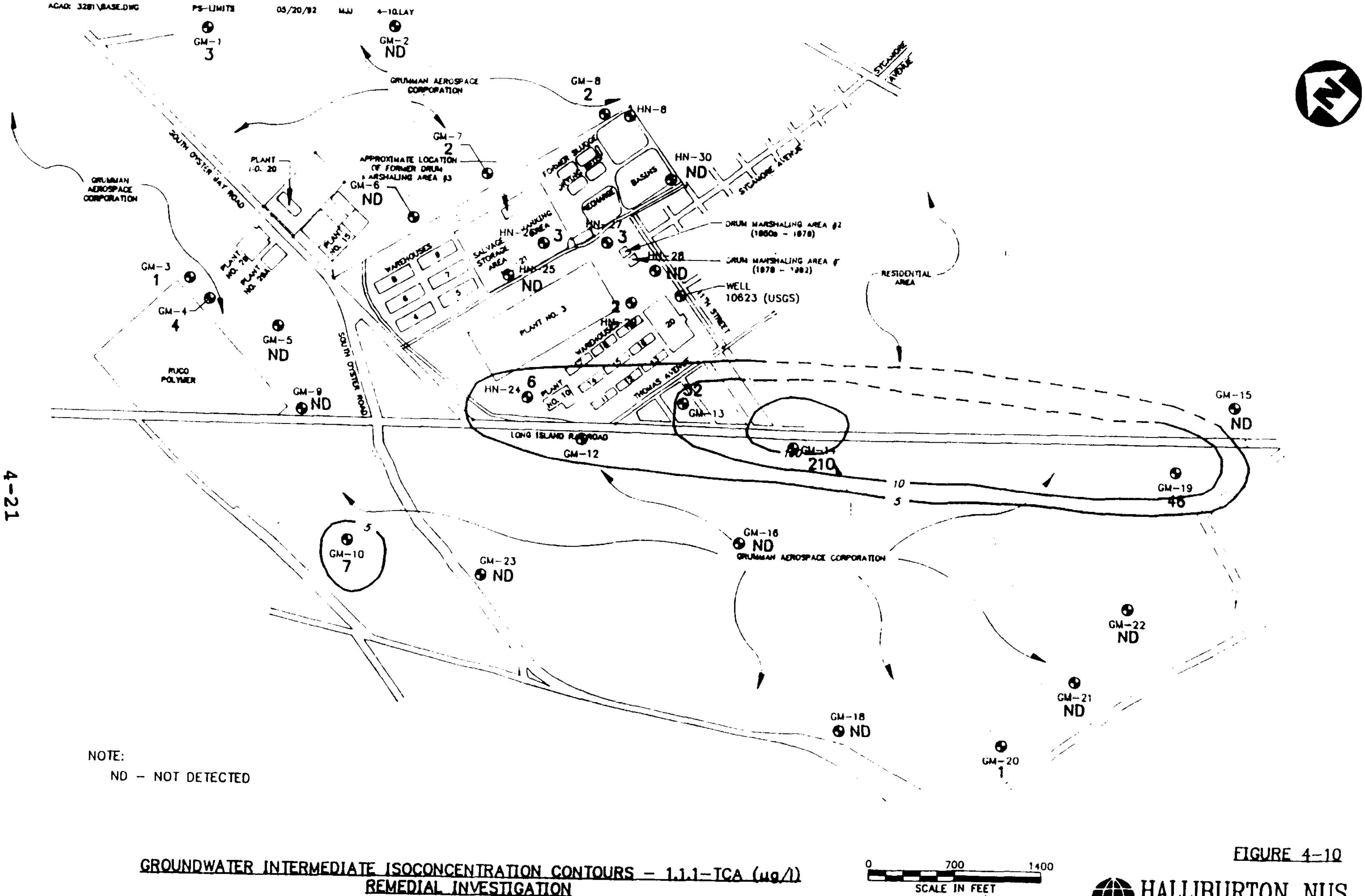
FIGURE 4-8

HALLIBURTON NUS
Environmental Corporation



GROUNDWATER INTERMEDIATE ISOCONCENTRATION CONTOURS – TCE (µg/l)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

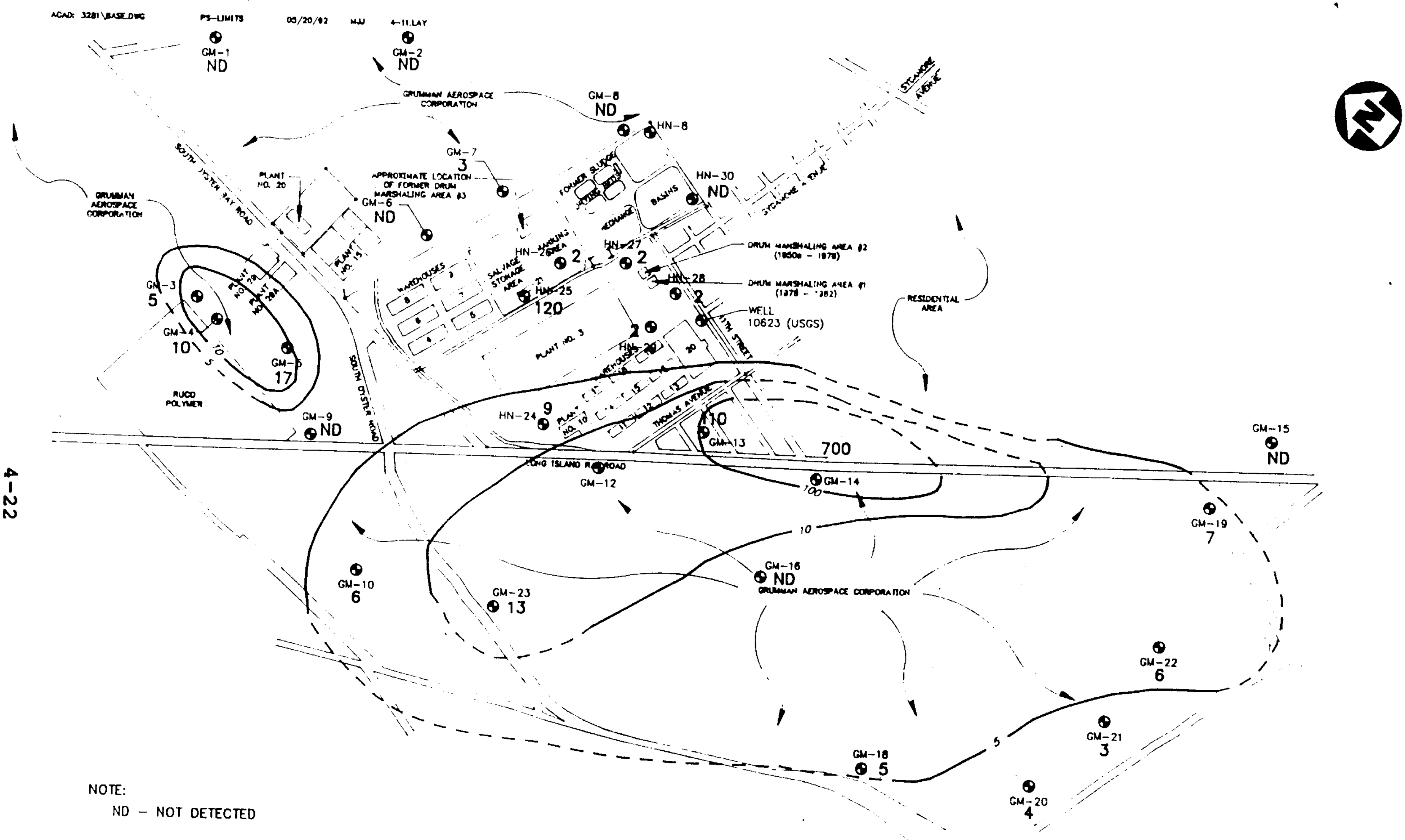
FIGURE 4-9



GROUNDWATER INTERMEDIATE ISOCONCENTRATION CONTOURS - 1,1,1-TCA (µg/l)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-10

HALLIBURTON NUS
Environmental Corporation



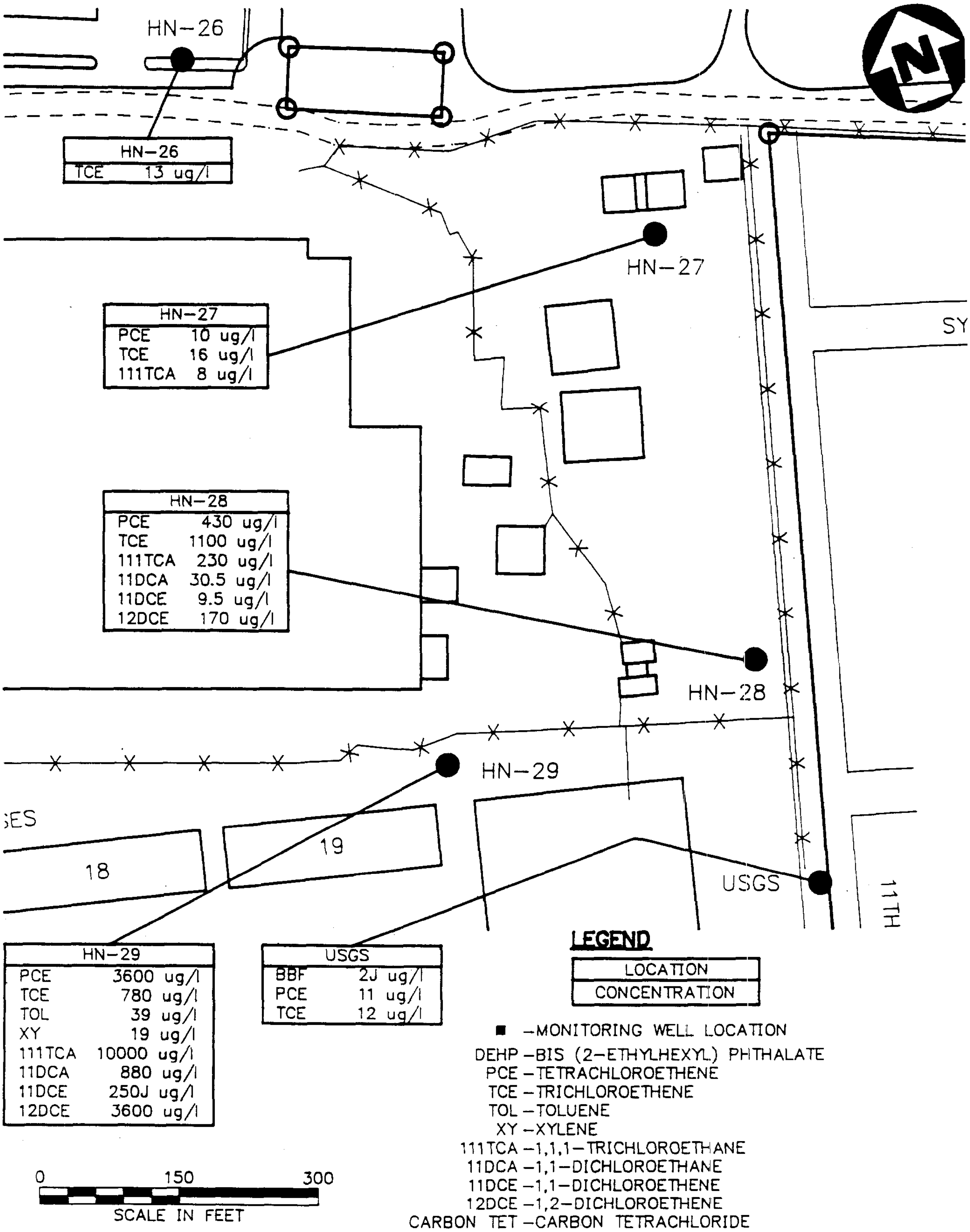
NOTE:
ND – NOT DETECTED

GROUNDWATER INTERMEDIATE ISOCONCENTRATION CONTOURS – PCE (μg/l)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

0 700 1400
SCALE IN FEET

FIGURE 4-11

HALLIBURTON NUS
Environmental Corporation

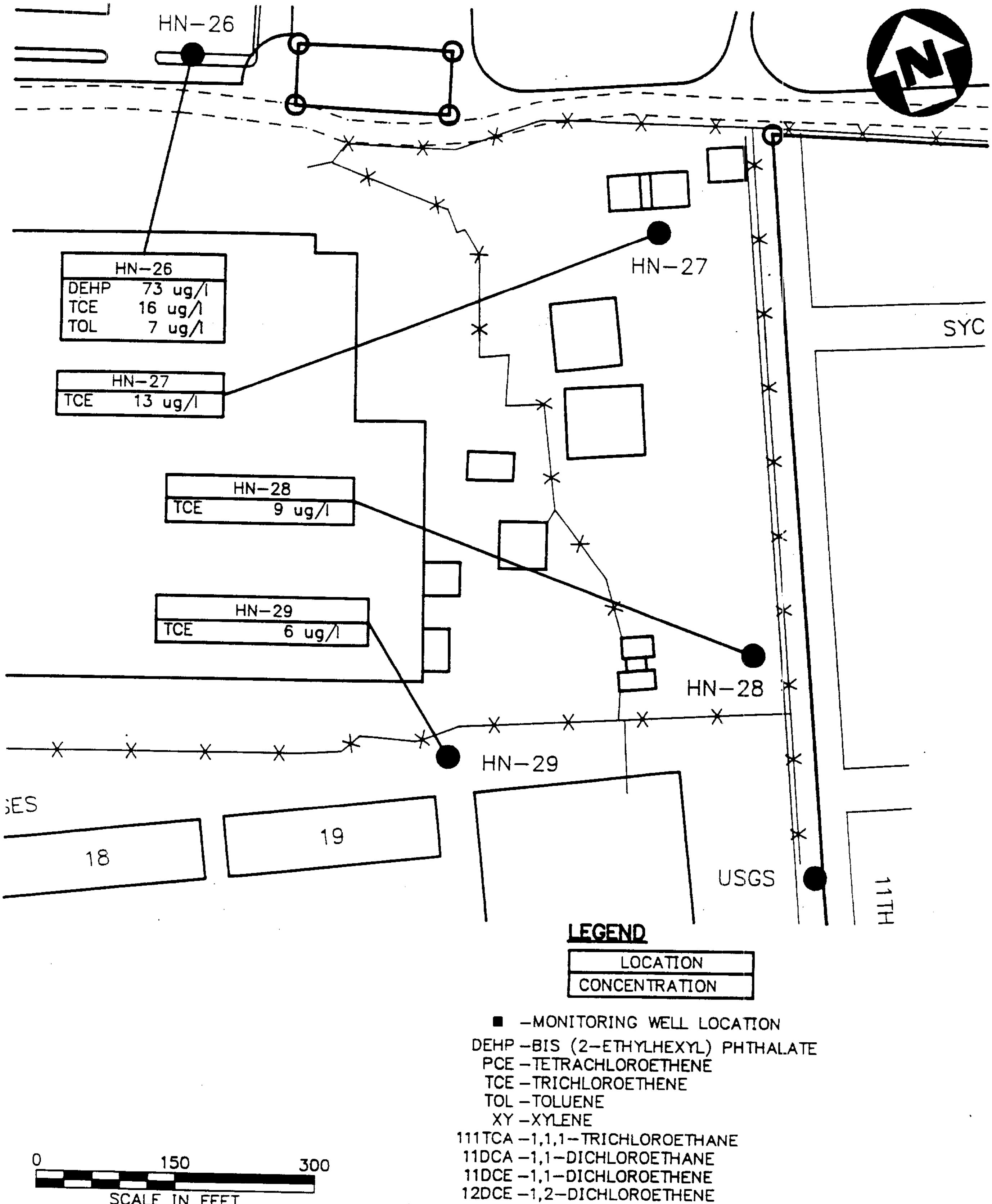


SHALLOW GROUNDWATER ORGANICS
ABOVE MCLS, ALS, RFD
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-12

HALLIBURTON NUS
Environmental Corporation

ACAD: 3281\BBASE200.DWG PS-AV2 02/27/92 MJJ IGO.LAY



INTERMEDIATE GROUNDWATER ORGANICS
ABOVE MCLS, ALS, RFD
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-13

HALLIBURTON NUS
Environmental Corporation

From this data, it can be seen that chlorinated ethenes and ethanes were detected in most of the shallow and intermediate wells. Most notable at Site 1 were concentrations of TCE ranging up to 1,100 ug/l, concentrations of PCE ranging up to 3,600 ug/l, concentrations of 1,2-DCE ranging up to 3,600 ug/l, concentrations of 1,1-DCE ranging up to 250 ug/l, concentrations of 1,1,1-TCA ranging up to 10,000 ug/l, and concentrations of 1,1-DCA ranging up to 880 ug/l. Most of these maximum concentrations were reported in HN-29S, which is located in the southwestern part of Site 1. Concentrations of chlorinated ethenes and ethanes of several hundred ug/l were reported for HN-28S, which is located in the southeastern portion of Site 1. These wells are located south and hydraulically downgradient of the former drum marshaling areas, where significant VOC soil contamination was reported.

Generally, VOCs are greater in shallow wells than in the intermediate wells. Some VOCs were detected infrequently, including ethylbenzene. The ethylbenzene and xylenes, along with substituted phenols and PAHs, were all detected in HN-29S. It is unusual to find PAHs in groundwater; usually, they are assumed to be contained in the sediment (or oil) fractions of a monitoring well sample. Only one other well yielded PAHs (the USGS well). All PAHs were detected at trace concentrations in the southern part of Site 1.

A comparison of volatile organic results in the deep monitoring well (HN-29D) at Site 1 and the corresponding intermediate monitoring well (HN-29I), found slightly higher concentrations of several volatile organics (and particularly 1,1,1 TCA at 48 ug/l) in the deep monitoring well as compared to the intermediate monitoring well (1,1,1 TCA at 2 ug/l). This monitoring well is considered a downgradient monitoring well for Site 1 as well as for NWIRP. This finding indicates that groundwater contamination may be present at greater than 250 feet at this site. It should be noted that deep contamination was observed in the production wells at Site 3. Also, since higher concentrations are found at a greater depth, it is possible that there is a second deeper groundwater plume at Site 1. Groundwater in a single upgradient deep monitoring well at Site 2 (HN-8D) was found to have similar concentrations as the intermediate monitoring well at this location, thereby supporting the possibility of a second deeper plume. The relative significance of this potential second deep plume compared to the shallow plume cannot be determined because the depth of groundwater contamination in this area has not been defined and it is possible that higher concentrations of volatile organics are present at still greater depths. It is also possible that groundwater is contaminated at all depths with the highest organic concentrations occurring at the shallow depths.

TICs were detected in almost every well. TICs included PAHs, substituted benzenes, alkanes, substituted phenols, chlorinated ethenes, and carboxylic acids. Quantitative risk assessment is not performed for TICs because the identities and quantities of TICs are uncertain. The quantities of TICs may be estimated, but these numbers are not appropriate for quantitative risk assessment since they may be over or under estimated by an order of magnitude. Those PAHs, benzenes, chlorinated ethenes and substituted phenols that were confidently identified are addressed quantitatively in Section 6.0. The TOX profiles in Appendix I contain quantitative information about the toxicity of chemicals from these classes of compounds.

Also included in Figures 4-6 through 4-11 are data collected during the Grumman Phase 1 RI. The combination of this data with the Navy data indicates that the contaminated groundwater plumes from Sites 1 and 3 merge below Plant 3. Also, the shallow groundwater contamination associated with Sites 1 and 3 end near the Long Island Railroad. At the same location and along the railroad toward areas southeast of Site 1, similar groundwater contamination is detected in the intermediate monitoring wells, indicating that the contaminated groundwater may have migrated into this zone. This downward migration of contaminants could be a result of production well operation (with screened intervals approximately 500 feet below the surface) and/or the effects of precipitation infiltration.

Further downgradient, near the runways, the intermediate groundwater contamination decreases significantly, indicating that either this distance is the extent of the bulk contamination migration in this direction or that the contamination has continued to sink in the aquifer, potentially toward the production wells. Increased groundwater contaminant concentrations are again found near Grummans recharge basins at the southern boundary of the property.

Both filtered and unfiltered groundwater samples were obtained from onsite wells. The unfiltered inorganic results are presented in Table 4-8. These are the data which will be used in the quantitative risk assessment, in accordance with EPA policy. However, many monitoring wells contain significant amounts of sediment, which may result in overestimation of risks from metals in groundwater. Therefore, filtered results are also presented (see Table 4-9) and will be referred to as needed. The distribution of inorganics above MCLs or health-based levels in unfiltered monitoring wells is shown in Figures 4-14 and 4-15.

It can be seen from a comparison of Tables 4-8 and 4-9 that there are significantly lower concentrations of most metals in the filtered samples. Some inorganics, such as beryllium, cobalt, mercury, and nickel, were detected in the unfiltered samples but were not detected in the filtered samples.

TABLE 4-8

POSITIVE DETECTIONS OF UNFILTERED INORGANIC GROUNDWATER CONTAMINANTS
SITE 1 (ug/l)
NWIRP, BETHPAGE, NEW YORK

Chemical	CRDL	IDL	HN-27S (upgrad)	HN-28S	HN-28SD (DUP HN28S)	HN-29S	USGS	HN-27I (upgrad)	HN-28I	HN-29I	HN-29D
Aluminum	200	25.0	33800	10600	9800	17100	4070	852	374		
Arsenic	10	1.0		15.4	17.4	10					
Barium	200	8.0	211	95.6	94.5	52.3	77.2	9.7	20.3		
Beryllium	5	1.0	2.9			2.8					
Cadmium	5	1.0	392								
Calcium	5000	13.0	8450	6280	6010	3860	7540	7580	5790	5160	6040
Chromium	10	8.0	169	19.8	17	30.1	85.7		59.2		
Chromium VI	10	-							61		
Cobalt	50	5.0	10.4			12.8	10.4				
Copper	25	2.0	823J	23.7	22.8	51.6	136	3.1			
Iron	100	21.0	106000	20700	19200	93000	125000	457	325		
Lead	3	1.0	43.4	7	7.4	18.8	124				
Magnesium	5000	45.0	2750	1550	1470	277	2820	1380	1440	1390	
Manganese	15	1.0	280	81.1J	78.8J	232J	1440J	28.5J	37.3J	26.9J	18.7
Mercury	0.2	0.20	0.2								
Nickel	40	8.0	26.6			10.9	62.9				
Potassium	5000	633	5230	4510	4360	7190	2060	5640	4940	10600	
Selenium	5	1.0				2.3					
Sodium	5000	21.0	19100	145000	143000	222000	19300	18400	16000	19100	15900
Vanadium	50	4.0	218	49.8	47	419	33.3				

TABLE 4-8
POSITIVE DETECTIONS OF UNFILTERED INORGANIC GROUNDWATER CONTAMINANTS
SITE 1 (ug/l)
NWIRP, BETHPAGE, NEW YORK
PAGE TWO

Chemical	CRDL	IDL	HN-27S (upgrad)	HN-28S	HN-28SD (DUP HN28S)	HN-29S	USGS	HN-27I (upgrad)	HN-28I	HN-29I	HN-29D
Zinc	20	5.0	123J				217				
Cyanide	5	2.0	2690	144	145	49.4	19.8				

CRDL = Contract Required Detection Limits
IDL = Instrument Detection Limit
J = Estimated

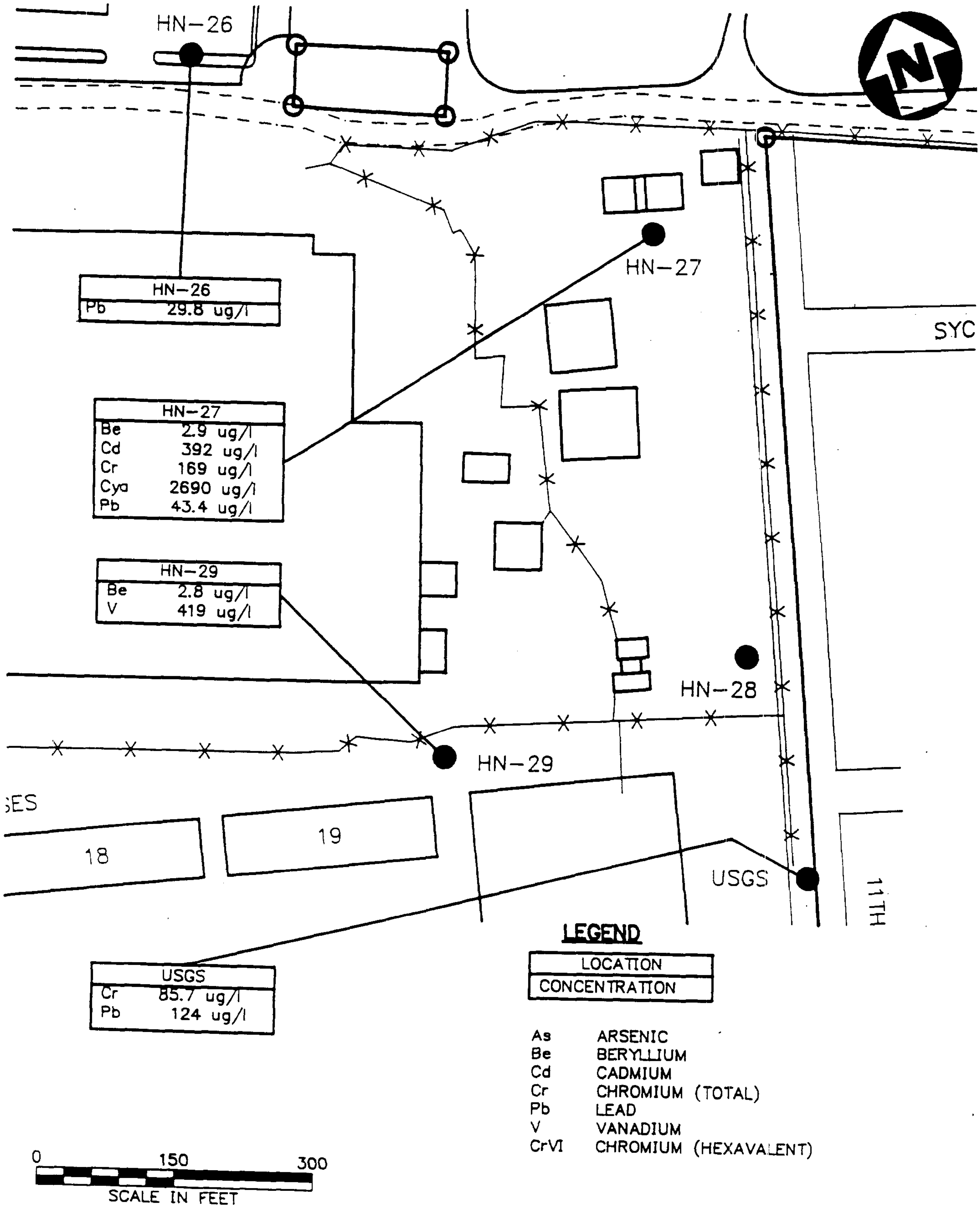
TABLE 4-9

POSITIVE DETECTIONS OF FILTERED INORGANIC GROUNDWATER CONTAMINANTS
SITE 1 (ug/l)
NWIRP, BETHPAGE, NEW YORK

Chemical	CRDL	IDL	HN-27S (upgrad)	HN-28S	HN-28SD (DUP HN28S)	HN-29S	USGS	HN-27I (upgrad)	HN-28I	HN-29I	NH-29D
Aluminum	200	25.0				293					
Arsenic	10	1.0		14.1	13.6	43.2					
Barium	200	8.0	9				15.9		18.2	13	
Cadmium	5	1.0	91J					2.8J			
Calcium	5000	13.0	6230J	4980	5430	2730	6390	6920J	5620	5190	6160
Chromium	10	8.0							56.7		
Copper	25	2.0	2					2.3			
Iron	100	21.0	25.4			214	568				
Magnesium	5000	45.0	1660J	1150	1260		1910	1320J	1410	1300	
Manganese	15	1.0	16.5J	21.3J	23J	1.6J	572J	21.2J	35.4J	7.9J	15.8
Potassium	5000	633	1100	3880	3820	6260	1810	5500	4800	12400	
Selenium	5	1.0				3.1					
Sodium	5000	21.0	19500J	134000	138000	230000	18500	18700J	15900	18700	15700
Thallium	10	1.0				1.7J					
Vanadium	50	4.0		10.1	9.5	34.3					
Zinc	20	5.0	168J	97.7	94.4		178				

CRDL = Contract Required Detection Limit
IDL = Instrument Detection Limit
J = Estimated

ACAD: 3281\BBASE200.DWG PS-AV2 02/27/92 MJJ SGI.LAY

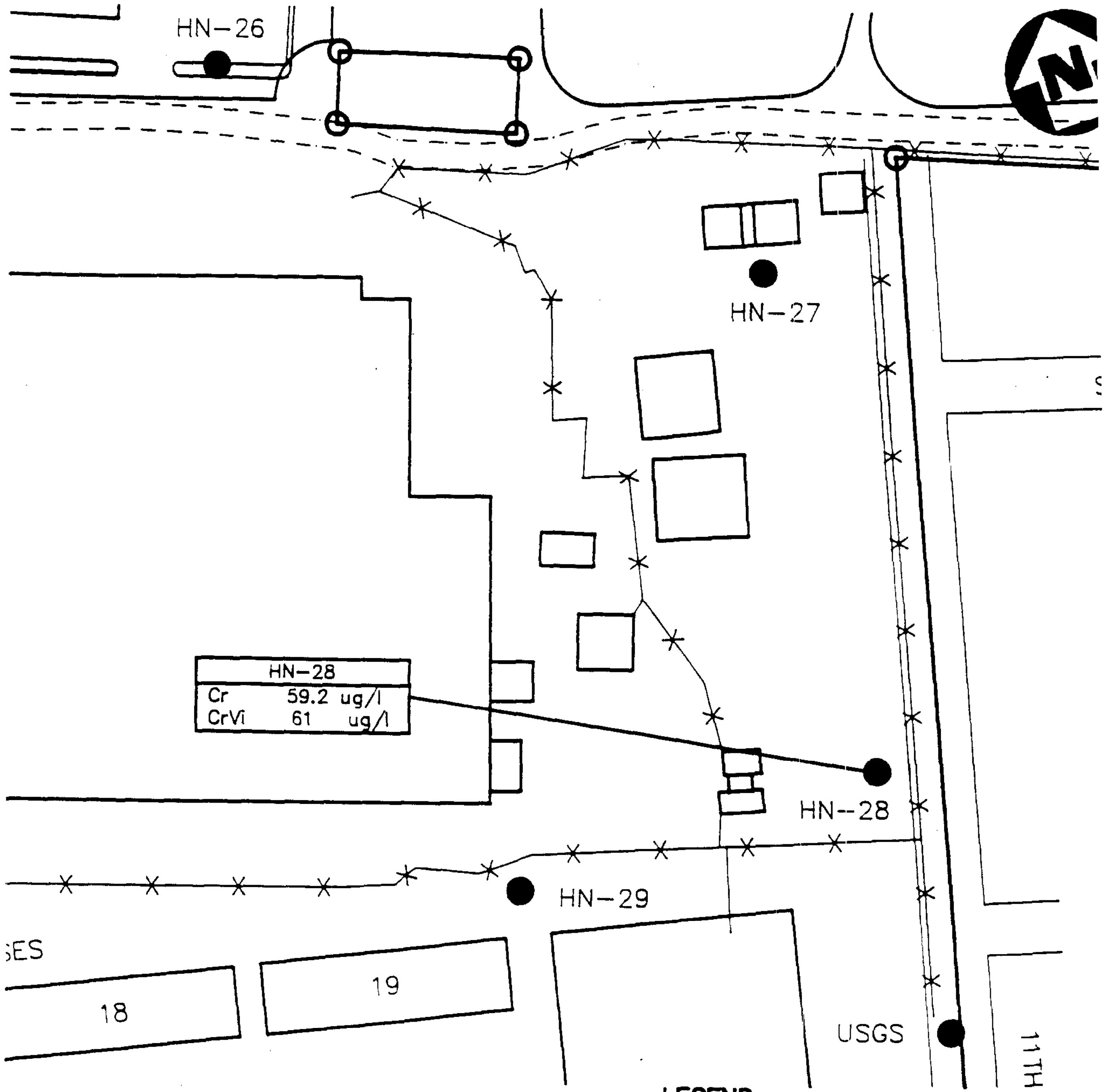


GROUNDWATER SHALLOW INORGANICS (UNFILTERED)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-14

HALLIBURTON NUS Environmental Corporation

ACAD: 3281\BBASE200.DWG PS-AV2 02/27/92 MJJ GII.LAY



LEGEND

LOCATION
CONCENTRATION

As	ARSENIC
Be	BERYLLIUM
Cd	CADMIUM
Cr	CHROMIUM (TOTAL)
Pb	LEAD
V	VANADIUM
CrVI	CHROMIUM (HEXAVALENT)

0 150 300
SCALE IN FEET

GROUNDWATER INTERMEDIATE INORGANICS
(UNFILTERED)
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-15

HALLIBURTON NU
Environmental Corporatio

Results for total chromium and hexavalent chromium are presented in Table 4-8. Because the proportions of trivalent and hexavalent chromium in the total chromium cannot be accurately determined, both the total and hexavalent results are given. For purposes of risk assessment, chromium will be assumed to be hexavalent where hexavalent chromium was not analyzed. Total chromium will be treated as trivalent, and hexavalent chromium will be treated as hexavalent in the risk assessment for groundwater. Although this will result in some overestimation of risk, the toxicity of trivalent chromium is low enough, especially relative to hexavalent chromium, that its impact on the quantitative assessment will be negligible.

Notable results in unfiltered monitoring wells include beryllium in HN-27S (2.9 ug/l) and HN-29S (2.8 ug/l); cadmium in HN-27S (392 ug/l); chromium in HN-27S (169 ug/l), USGS (85.7 ug/l), and HN-28I (59.2 ug/l); iron in USGS (125,000 ug/l), HN-29S (93,000 ug/l), and HN-27S (106,000 ug/l); lead in USGS (124 ug/l); vanadium in HN-29S (419 ug/l). Notable results in filtered samples include cadmium in HN-27S (91 ug/l); chromium in HN-28I (56.7 ug/l); and thallium in HN-29S (1.7 ug/l). There is no clear pattern or definable plume of inorganic contamination, although inorganic concentrations were highest in HN-27S and HN-29S.

The concentration of the inorganics in the deep monitoring well as compared to the intermediate monitoring well are generally similar or lower. This indicates that inorganic contamination is limited to the shallow groundwater.

4.1.5 Surface Soils

Seven surface soil samples were obtained at Site 1. Sampling locations were selected based on historical information regarding site chemical handling and disposal activities. Surface soil samples were collected at points on a relatively uniform, 300-foot by 300-foot grid and at one field-determined, opportune location.

Sample locations are displayed in Figure 2-4. The analytical results for the surface soil samples are summarized in Tables 4-10 and 4-11, which provide evidence of organic and inorganic contaminants, respectively. In general, trace to low levels of VOCs were detected in surface soil samples. The highest reported concentrations of these compounds occurred in a sample from the western part of Site 1 (PCE up to 51 ug/kg, TCE up to 11.5 ug/kg). The distribution of TCE and PCE in the surface soils is illustrated in Figures 4-16 and 4-17. The isoconcentration lines were generated via direct interpolation between individual data points. Another primary site contaminant, 1,1,1-trichloroethane (1,1,1-TCA), was not detected in surface soils.

TABLE 4-10

OCCURRENCE AND DISTRIBUTION OF SURFACE SOIL CONTAMINANTS
SITE 1 - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

Compound	CRQL	Number Positive Detections/ Samples Analyzed	Maximum Positive Detection	Location of Maximum Concentration	Representative Concentration*
Trichloroethene	5	3/7	11.5	SS103	7.4
Tetrachloroethene	5	2/7	51	SS103	27.4
4,4'-DDE	17	1/2	270J	SS102	270
4,4'-DDT	17	1/2	170J	SS102	170
gamma-Chlordane	80	1/2	240J	SS102	240
Aroclor 1248	80	2/2	7900	SS102	7900
bis(2-Ethylhexyl)phthalate	330	5/7	200J	SS106	179
Butylbenzyl phthalate	330	3/7	180J	SS105	180
2-Methylnaphthalene	330	2/7	160J	SS106	160
Naphthalene	330	1/7	53J	SS106	53
Acenaphthene	330	3/7	53J	SS102	53
Phenanthrene	330	7/7	700	SS104	554
Anthracene	330	3/7	66J	SS104	66
Fluoranthene	330	7/7	1100	SS104	837
Pyrene	330	7/7	950	SS104	793
Benzo[a]anthracene	330	7/7	550	SS104	439
Chrysene	330	7/7	580	SS104	473
Benzo[b]fluoranthene	330	7/7	680	SS104	575
Benzo[k]fluoranthene	330	6/7	620	SS104	477

TABLE 4-10
OCCURRENCE AND DISTRIBUTION OF SURFACE SOIL CONTAMINANTS
SITE 1 - ORGANIC (ug/kg)
PAGE TWO

Compound	CRQL	Number Positive Detections/ Samples Analyzed	Maximum Positive Detection	Location of Maximum Concentration	Representative Concentration*
Benzo[a]pyrene	330	7/7	620	SS104	502
Indeno[1,2,3-c,d]pyrene	330	7/7	430	SS104	349
Dibenz[a,h]anthracene	330	2/7	150J	SS101	150
Benzo[g,h,i]perylene	330	7/7	420	SS104	350
Fluorene	330	2/7	44J	SS104	44
PCBs (TICs)		7/7	P	SS103	-

Background soil concentrations are presented in Table 4-4
* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected
TIC = Tentatively Identified Compound
PCB = Polychlorinated Biphenyl
CRQL = Contract Required Quantitation Limit
J = Estimated
P = Present

TABLE 4-11

OCCURRENCE AND DISTRIBUTION OF SURFACE SOIL CONTAMINANTS
SITE 1 - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

Element	CRDL	IDL	Number Positive Detections/ Samples Analyzed	Concentration Range	Location of Maximum Concentration	Representative Concentration*
Aluminum	40	36.2	6/7	3370-10800	SS102	8468
Arsenic	2	0.78	6/7	3.4J-55.8J	SS106	33.1
Barium	40	0.48/0.78	6/7	10.8-59J	SS106	46.6
Chromium	2	2.1	6/7	18.8J-61.1	SS103	49.1
Cobalt	10	4.4	2/7	ND-5.3J	SS106	4.4
Iron	20	7.0/7.4	6/7	7266-15900	SS103	14708
Mercury	0.10	0.10	-	ND-5.54		2.8
Nickel	8	4.8	6/7	6.5J-19.2J	SS016	16.1
Silver	2	0.18	5/7	ND-6.3		3.5
Vanadium	10	3.7	6/7	13.7J-39.3J	SS103	30.4
Cyanide	2	2.0	1/7	ND-5.4	SS106	3.2

Background soil concentrations are presented in Table 4-5.
* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected
CRDL = Contract Required Detection Limit
IDL = Instrument Detection Limit
J = Estimated

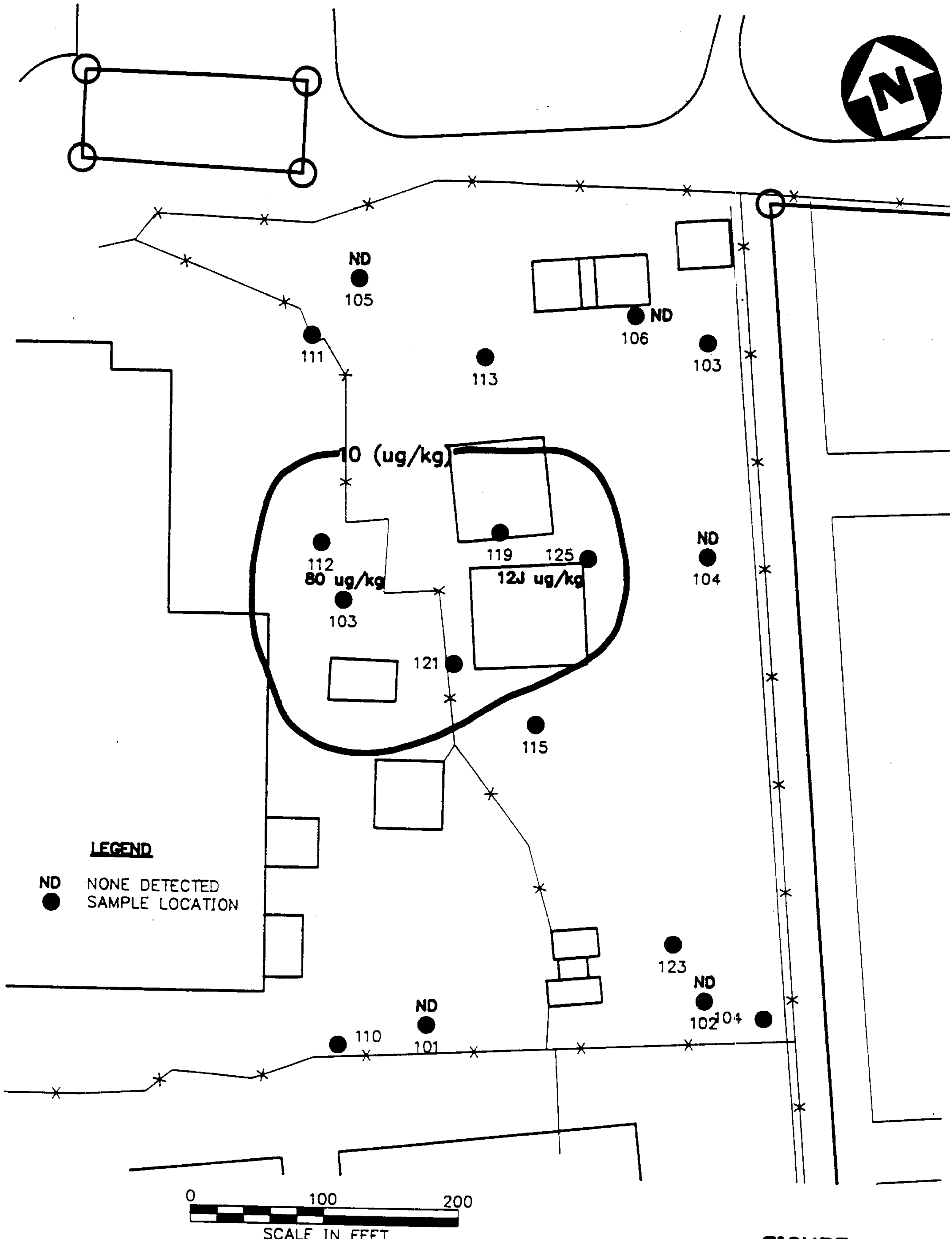


FIGURE 4-16

SITE 1 - SURFACE SOIL RESULTS - PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation

ACAD: 3281\SITE1.DWG 02/27/92 MB 4-16.LAY

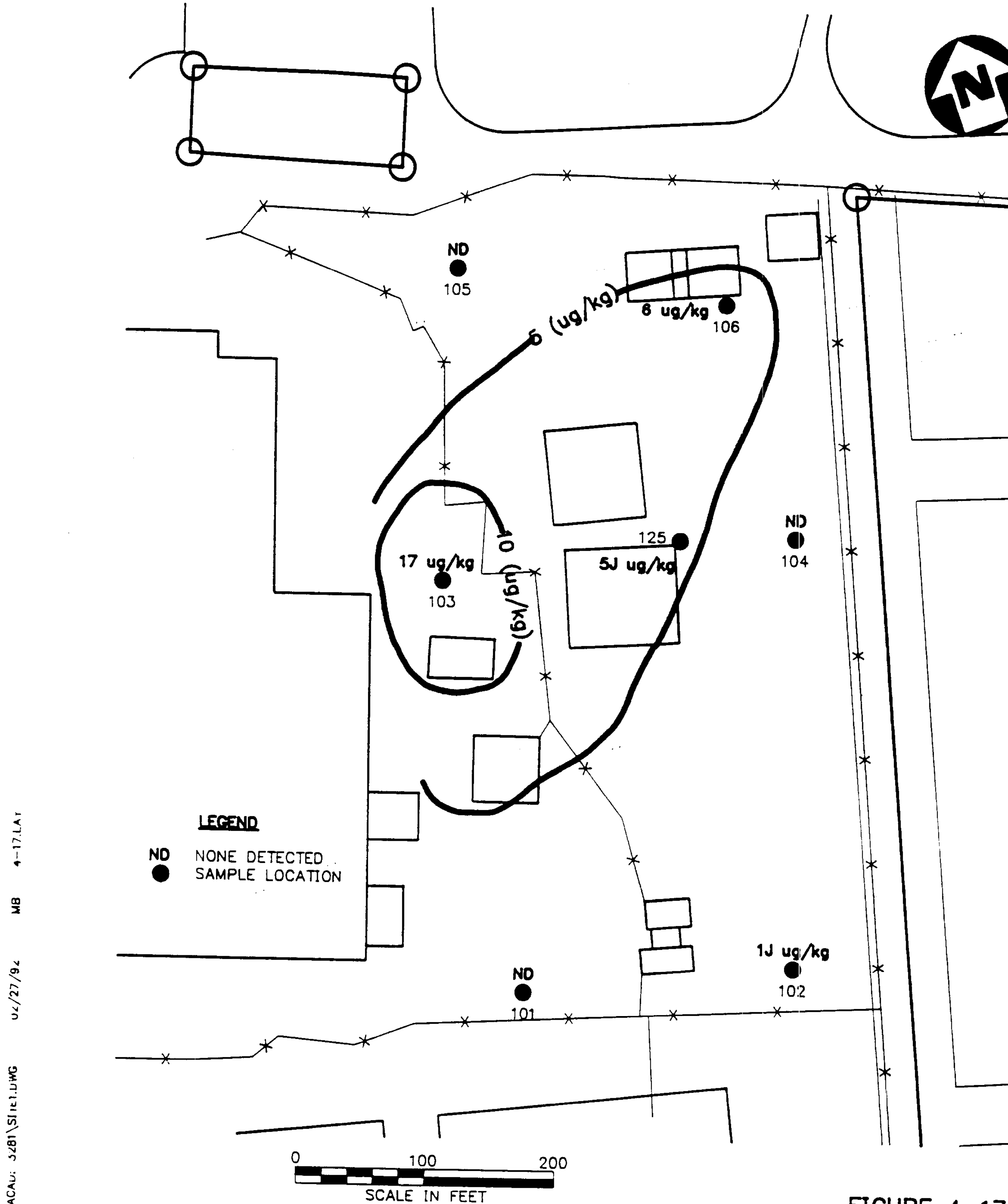


FIGURE 4-17

SITE 1 - SURFACE SOIL RESULTS - TCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation

Low to moderate concentrations of phthalate esters (under 300 ug/kg) and polynuclear aromatic hydrocarbons (PAHs) (under 20,000 ug/kg) were also detected throughout the site; no well-defined pattern of contamination by PAHs and phthalate is evident.

Polychlorinated biphenyls (PCBs) such as Aroclor 1248 and Aroclor 1254 were identified in surface soils. PCBs were detected in all areas of Site 1. Concentrations of PCBs ranged up to 7,900 ug/kg, with the highest concentration occurring in the southern portion of Site 1.

PCBs were tentatively identified in all Site 1 surface soil samples. In one duplicate pair, the estimated concentrations of PCBs varied widely, by a few orders of magnitude. PCBs as TICs are used mainly in a confirmation basis. TICs are not appropriate for quantitative risk assessment because their identities and quantities are uncertain. Those PCBs that were confidently identified are addressed quantitatively in Section 6.0. The TOX profiles in Appendix I contain qualitative information about the toxicity of PCBs.

Pesticides were detected in one surface sample from the southern part of Site 1. The pesticides included DDT and DDE (170 ug/kg and 270 ug/kg, respectively) and gamma-chlordane (240 ug/kg). These compounds were not detected at any other sample location.

For comparative purposes, concentrations of organic compounds in background (subsurface) soil sample are shown in Table 4-4. It can be seen that PAHs, which are common environmental contaminants, were detected at levels up to approximately 7,000 ug/kg in background soil.

Inorganic elements detected at Site 1 at the activity are displayed in Table 4-11. Many metals were detected above levels observed in background (subsurface) soil. Mercury and silver were found at scattered and inconsistent positive detections. Cyanide was detected at low levels (up to 5.36 mg/kg) in one sample. Substances associated particularly with plating detected at the two sites are nickel, silver, cyanide, and chromium (Sittig, 1985).

At Site 1, the highest-concentration sample was SS-6, which was located in the northeastern corner of Site 1. It is apparent that the patterns of distribution of organic and inorganic contaminants are quite different.

4.1.6 Summary

The results of the soil-gas survey indicated that a source area of volatile organic contamination was present near the former drum marshaling area and extended to the south. The results of the soil boring program confirmed a source area of volatile organics near the former drum marshaling areas. Contaminants PCE and TCE at levels up to 4,800 ug/kg and 200 ug/kg, respectively, were found in Site 1 subsurface soils. Levels of inorganic contamination were relatively low, when compared to the volatile organic contamination. Nevertheless, significant concentrations of PCBs (7,900 ug/kg), pesticides (440 ug/kg), PAHs, and inorganics were found in the soils at Site 1. There is no apparent distinct pattern associated with the nonvolatile organic contamination.

The temporary monitoring well program and monitoring well program confirmed that Site 1 is an apparent source area of groundwater contamination starting near the former drum marshaling area and extending southwest (hydraulically down gradient). TCE, PCE, and 1,1,1-TCA were detected at maximum concentrations of 1,500 ug/l, 7,700 ug/l, and 10,000 ug/l, respectively. Inorganic contamination was also found.

4.2 Recharge Basins (Site 2)

4.2.1 Soil-Gas

Soil-gas sampling was performed to help define the extent of volatile organic contamination and to assist in the selection of sampling locations. The analysis included the parameters of 1,1-DCE, t-1,2-DCE, 1,1-DCA, c-1,2-DCE, 1,1,1-TCA, TCE, and PCE. The concentrations referred to in this section are a sum of PCE and TCE concentrations. Soil-gas sampling locations and results are presented in Figures 4-18 and 4-19.

The results of the soil-gas analysis are presented in Table 4-12. Based on these results, there appears to be a source, in the approximate center of the site, where readings of 11.22 ug/l and 10 ug/l were obtained in the shallow soil-gas samples. Lesser concentrations (e.g., 3.05 ug/l, 0.79 ug/l) were obtained closer to the edges of Site 2, and non-detects of volatile organics were obtained at the far edges. The highest-concentration area of contaminants in Site 2 corresponds to the highest-concentration trichloroethene (up to 32 ug/kg at location 215, 3-foot depth) detected in Site 2 (see Section 4.3.2). Similar, but lower, concentrations were detected in the deep soil-gas results.

QA/QC samples are also presented in Table 4-12. Analysis of the field control sample (blank) and laboratory blank results indicated minimal background contamination. The duplicate results were generally within +/- 30%. These results indicate that the data is of relatively good quality.

4.2.2 Temporary Monitoring Wells

Eleven temporary wells at Site 2 were sampled and analyzed for volatile organics including vinyl chloride, 1,1-DCE, t-1,2-DCE, 1,1-DCA, c-1,2-DCE, 1,1,1-TCA, 1,2-DCA, TCE, PCE. The location of the temporary monitoring wells is presented in Figure 2-2. A

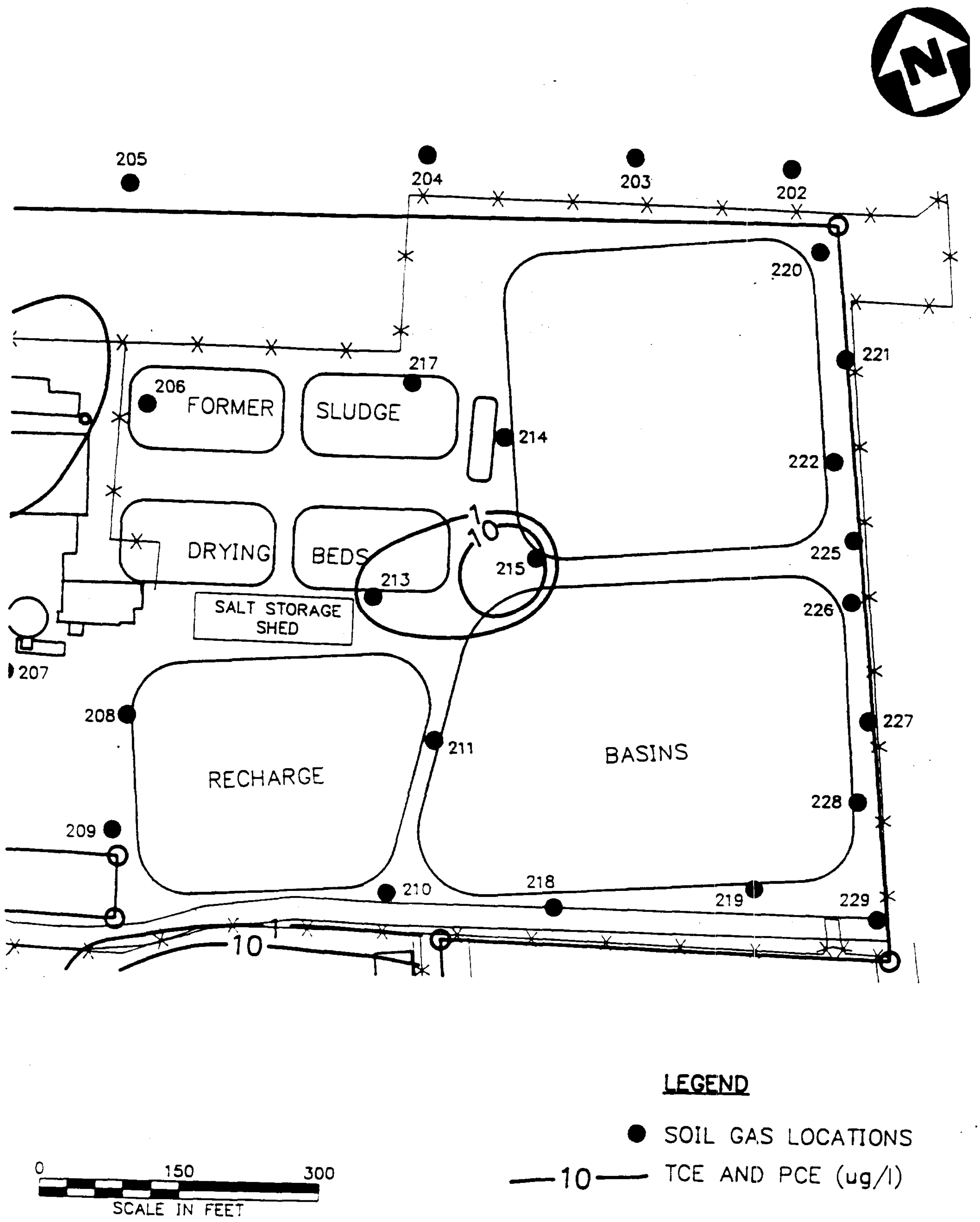


FIGURE 4-18

SOIL GAS RESULTS – SHALLOW
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NUS
Environmental Corporation

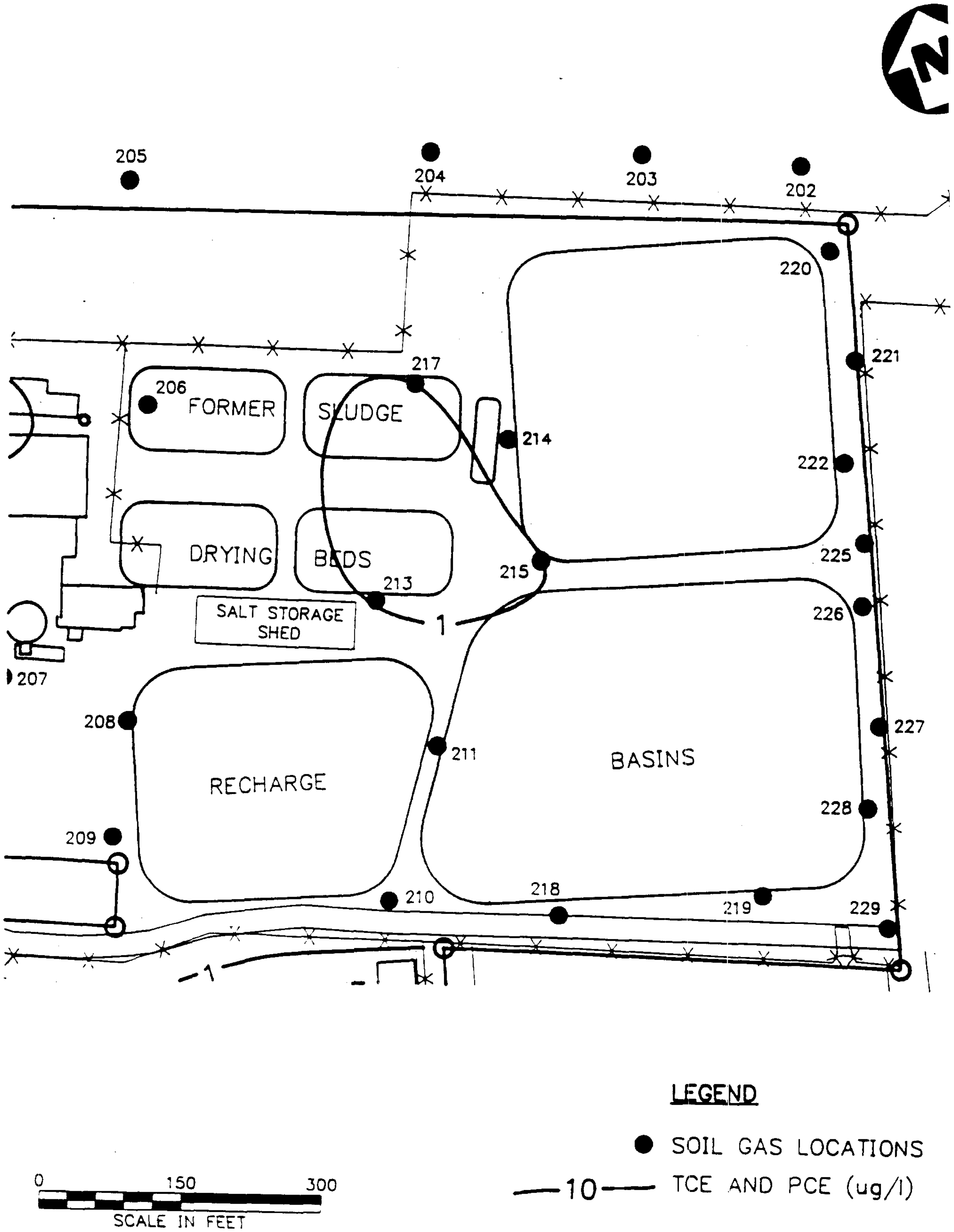


FIGURE 4-1

SOIL GAS RESULTS – DEEP
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NEW YORK

HALLIBURTON NU
Environmental Corporati

TABLE 4-12
SOIL-GAS RESULTS - SITE 2 (ug/l)
NWIRP; BETHPAGE, NY

Sample	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
202D	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
202S	<1.0	<1.0	<1.0	<1.0	0.39	<0.10	<0.05
203D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
203S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
204S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
205D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.07
206D	6.3	<1.0	<1.0	<1.0	<0.10	0.32	0.05
206S	1.2	<1.0	<1.0	<1.0	0.19	2.2	0.85
207D	2.8	<1.0	<1.0	<1.0	<0.10	<0.10	0.60
207S	20	<1.0	<1.0	<1.0	<0.10	0.21	0.11
208D	1.4	<1.0	<1.0	<1.0	<0.10	<0.10	0.41
298S	4.3	<1.0	<1.0	<1.0	0.17	0.54	0.25
209D	1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.06
209S	1.4	<1.0	<1.0	<1.0	<0.10	<0.10	0.17
210D	1.4	<1.0	<1.0	<1.0	<0.10	0.12	0.23
210S	1.2	<1.0	<1.0	<1.0	<0.10	<0.10	0.41
211D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
211S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.50
213D	5.1	<1.0	<1.0	<1.0	1.3	2.2	0.42
213S	3.1	<1.0	<1.0	<1.0	1.0	0.88	0.18
214D	<1.0	<1.0	<1.0	<1.0	0.36	<0.10	<0.05
214S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
215D	6.4	<1.0	<1.0	<1.0	0.46	1.8	0.27
215S	1.3	<1.0	<1.0	<1.0	0.34	11	0.22
216D	1.2	<1.0	<1.0	<1.0	<0.10	<0.10	0.09
216S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	0.28
217D	<1.0	<1.0	<1.0	<1.0	0.33	1.8	0.11
217S	<1.0	<1.0	<1.0	<1.0	<0.10	0.12	<0.05
218D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
218S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
219D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
219S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

TABLE 4-12
SOIL-GAS RESULTS - SITE 2 (ug/l)
PAGE TWO

Sample	11DCE	t12DCE	11DCA	c12DCE	111TCA	TCE	PCE
220D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
220S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
221D	2.0	<1.0	<1.0	<1.0	<0.10	0.15	<0.05
221S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
222D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
222S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
225D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.1	<0.05
225S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
226D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
226S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
227D	14	<1.0	<1.0	<1.0	0.59	<0.10	<0.05
227S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
228D	2.0	<1.0	<1.0	<1.0	0.11	0.18	0.19
228S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
229D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
229S	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
FIELD CONTROL SAMPLES							
201	<1.0	1.0	2.0	<1.0	<0.10	<0.10	<0.05
212	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
224	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
LABORATORY DUPLICATE ANALYSES							
218D	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
218DR	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223R	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
LABORATORY BLANKS							
218DB	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05
223B	<1.0	<1.0	<1.0	<1.0	<0.10	<0.10	<0.05

11DCE = 1,1-dichloroethene
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
111TCA = 1,1,1-trichloroethane
TCE = trichloroethene
PCE = tetrachloroethene

S = Shallow
D = Deep

summary of the organic contaminants detected at Site 2 is provided in Table 4-13.

TCE was the only volatile organic detected at Site 2. It was present at a low concentration (9 ug/l) and only detected in four temporary wells. Two wells contained the maximum concentration of TCE detected, or 9 ug/l (G-209, G-218). Both wells were located in the southern portion of the site.

4.2.3 Subsurface Soils

Subsurface sample locations are presented in Figure 2-3. Table 4-14 presents the distribution of organic chemicals in subsurface soil. Low-level VOCs, especially TCE and PCE, were detected at the site. Figures 4-20 and 4-21 illustrate the subsurface distribution of detections of TCE and PCE. TCE was detected at the 3-foot depth of SB-215 at 32 ug/kg. In general, concentrations of compounds in samples obtained at 19 feet were not significantly greater than concentrations at 3 feet. There appears to be overall trace-to-low-level chlorinated ethene contamination at the site.

PCBs were confidently and tentatively identified at some locations in Site 2 (206 and 215, three-foot depth). The only confidently identified Aroclor was Aroclor 1248, which was detected up to 6,800 ug/kg.

PAHs, which are common environmental contaminants, were confidently and tentatively identified in subsoil throughout Site 2. Phthalate, which are plasticizers and are also common environmental contaminants as well as common blank contaminants, were detected at low concentrations (under 12,000 ug/kg) at several locations at Site 2. PCBs as TICs are used mainly on a confirmation basis. TICs are not appropriate for quantitative risk assessment because their identities and quantities are uncertain (quantities may vary by an order of magnitude). Those PCBs, PAHs, and phthalate that were confidently identified are addressed quantitatively in Section 6.0. The TOX profile in Appendix I contain qualitative information about the toxicity of PCBs, PAHs, and phthalates.

Chlorinated solvents were detected at trace levels in background soil samples (See Table 4-4). PAHs were also detected in background soil samples up to approximately 7,000 ug/kg.

Table 4-15 displays inorganic analytical results for subsurface soil. The following metals were detected at the highest concentrations in Site 2: mercury and silver. These metals can be associated with plating (Sittig, 1985). The highest-concentration samples in Site 2 were SB-229 and SB-217, with various high-concentration detections scattered throughout the site. SB-229 was located in the southwestern corner of Site 2, whereas SB-217 was located in the area of the former sludge drying beds. Sample SB-

TABLE 4-13

TEMPORARY MONITORING WELL
SITE 2 - ORGANIC RESULTS (ug/l)
NWIRP, BETHPAGE, NY

Temporary Well #	VC	11DCE	T12DCE	11DCA	C12DCE	111TCA	112DCA	TCE	PCE
202	5U	5U	5U	5U	5U	5U	5U	5U	5U
204	5U	5U	5U	5U	5U	5U	5U	5U	5U
205	5U	5U	5U	5U	5U	5U	5U	7	5U
209	5U	5U	5U	5U	5U	5U	5U	9	5U
215	5U	5U	5U	5U	5U	5U	5U	8	5U
218	5U	5U	5U	5U	5U	5U	5U	9	8
219	5U	5U	5U	5U	5U	5U	5U	5U	5U
225	5U	5U	5U	5U	5U	5U	5U	5U	5U
227	5U	5U	5U	5U	5U	5U	5U	5U	5U
229	5U	5U	5U	5U	5U	5U	5U	5U	5U

U - Undetected
11DCE = 1,1-dichloroethene
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
111TCA = 1,1,1-trichloroethane
TCE = trichloroethene
PCE = tetrachloroethene
VC = vinyl chloride

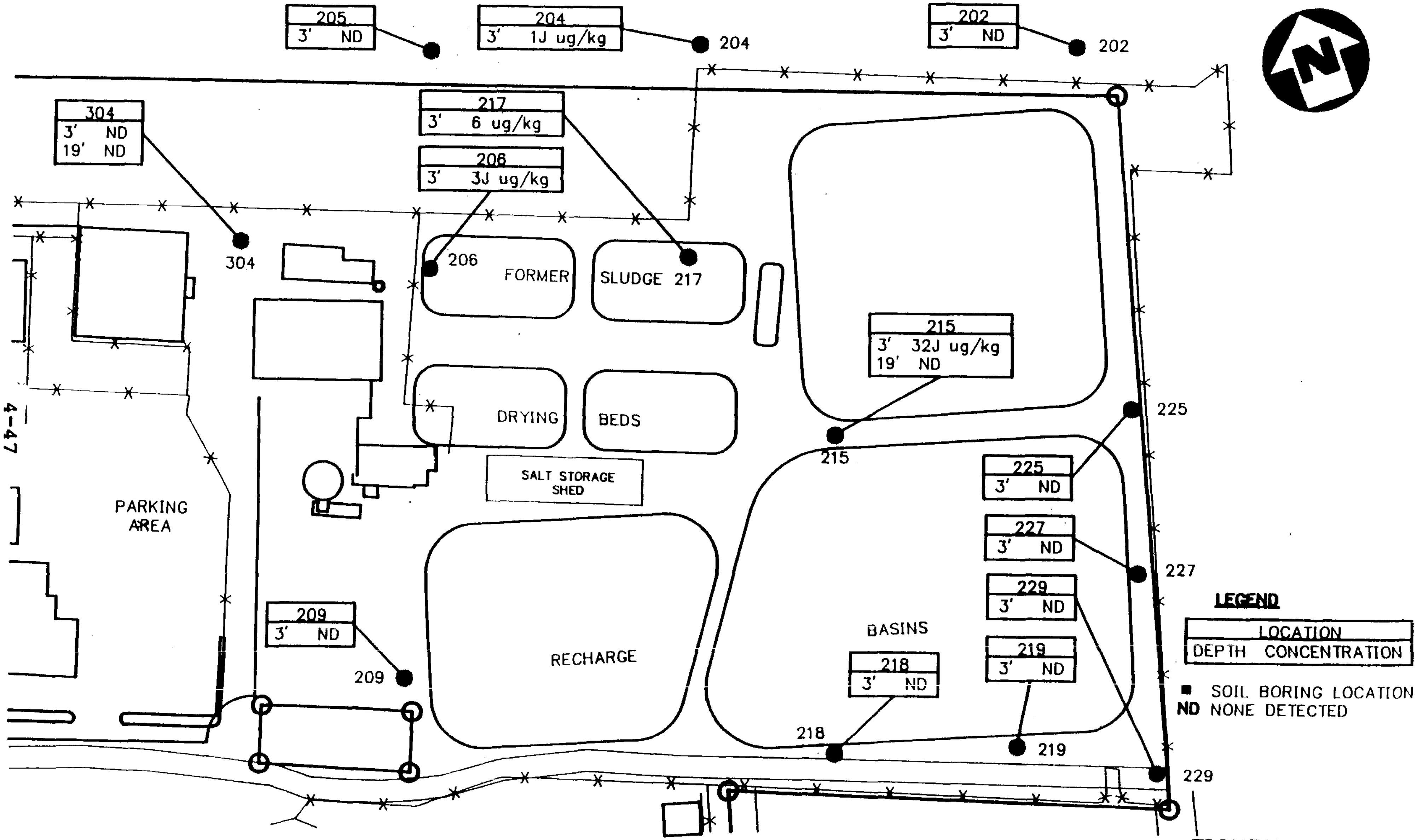
TABLE 4-14

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS
SITE 2 - ORGANIC (ug/kg)
NWIRP, BETHPAGE, NY

	CRQL	Number Positive Detections/ Samples Analyzed	Maximum Positive Concentration	Location of Maximum Concentration	Representative Concentration*
Trichloroethene	5	3/9	32J	SB215	13.8
Tetrachloroethene	5	3/9	6	SB219	4.0
Aroclor 1248	80	1/1	6800	SB229	6800
bis(2-ethylhexyl)phthalate	350	3/9	62J	SB217	62
Di-n-butyl phthalate	350	3/9	40J	SB227	40
Dibenzofuran	350	1/12	109J	SB217	109
Naphthalene	350	1/12	86J	SB217	86
Acenaphthene	350	1/12	270J	SB217	213
Fluorene	350	1/12	180J	SB217	180
Anthracene	350	1/12	220J	SB217	196
Phenanthrene	350	5/9	1300	SB217	564
Fluoranthene	350	5/9	1900	SB217	805
Pyrene	350	5/9	1800	SB217	760
Benzo[b]fluoranthene	350	3/9	980	SB217	462
Benzo[k]fluoranthene	350	3/9	730	SB217	369
Benzo[a]pyrene	350	3/9	810	SB217	397
Indeno[1,2,3,-c,d]pyrene	350	2/9	62J	SB229	62
Benzo[g,h,i]perylene	350	3/9	490	SB217	281
Benz[a]anthracene	350	2/9	740	SB217	379
Chrysene	350	2/9	910	SB217	444
2-Methylnaphthalene	350	1/9	52J	SB217	52
TIC PCBs	-	3/9	P	SB229	-

Background soil concentrations are presented in Table 4-4.
* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
- = Not Detected
CRQL = Contract Required Quantitation Limit
J = Estimated
P = Present

ACAD: 3281\SITE2.DWG 02/27/92 MB PS-LIMITS 4-20.LAY



4-47

FIGURE 4-20

SITE 2 – SUBSURFACE SOIL RESULTS – TCE

REMEDIAL INVESTIGATION

0 150 300

HALLIBURTON NUS

ACAD: 3281\SITE2.DWG 02/27/92 MB PS-LIMITS 4-21.LAY

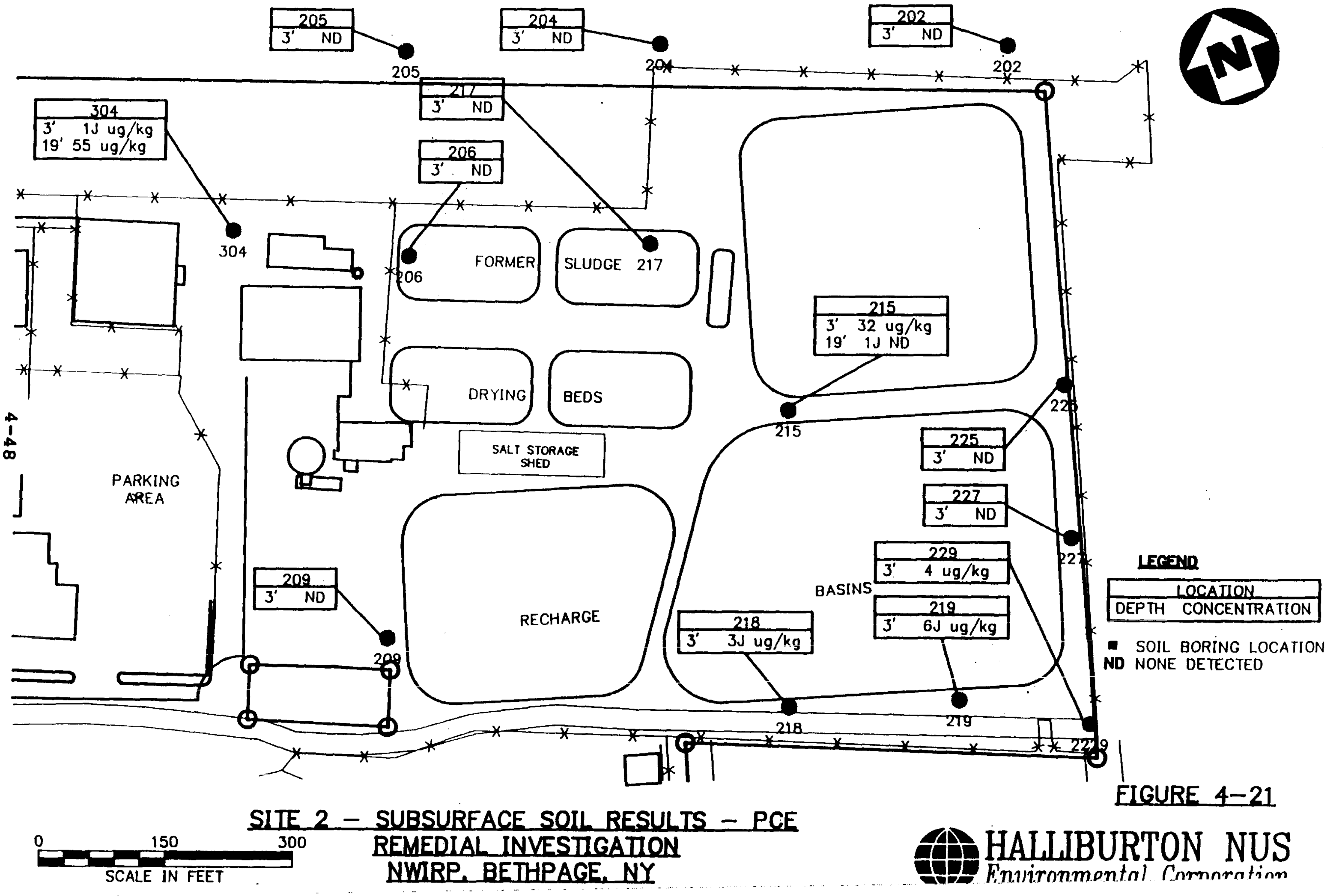


FIGURE 4-21

SITE 2 - SUBSURFACE SOIL RESULTS - PCE
REMEDIAL INVESTIGATION
NWIRP, BETHPAGE, NY

HALLIBURTON NUS
Environmental Corporation

TABLE 4-15

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS
SITE 2 - INORGANIC (mg/kg)
NWIRP, BETHPAGE, NY

Element	CRDL	IDL	Number Positive Detections/ Samples Analyzed	Concentration Range	Location of Maximum Concentration	Representative Concentration
Aluminum	40	36.2	9/12	1600-9370	SB204(1)	6767
Arsenic	2	0.78	7/12	ND-10.7	SB229	5.9
Barium	40	1.7	9/12	3.1-29.9	SB204(1)	17.6
Mercury	0.1	0.10	4/12	ND-0.32	SB218	0.18
Silver	2	0.18/0.24	4/12	ND-2.65	SB206	1.3

Background soil concentrations are presented in Table 4-5.
* Upper 95% confidence limit (UCL) on arithmetic average, or maximum if UCL exceeds maximum detected.
ND = Not Detected
CRDL = Contract Required Detection Limit
IDL = Instrument Detection Limit
(1) = Background sample